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ZOOPLANKTON PRODUCTION IN LAKE ONTARIO AS INFLUENCED BY ENVIRONMENTAL PERTURBATIONS

Donald C. McNaught, et al

State University of New York at Albany

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*The ratio of the number of Bosmina longirostris, the most successful eutrophic species, to Diaptomus sicilis, the most oligotrophic form, supported this conclusion.

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ABSTRACT

The Crustacean zooplankton are excellent indicators of environmental perturbation, especially if enough of their biology is known to explain why certain species increase with nutrient enrichment of lakes. The distribution of zooplankton in Lake Ontario suggested that eutrophic indicators were found in the vicinity of major urban centers. The ratio of the number of *Bosmina longirostris*, the most successful eutrophic species, to *Diaptomus sicilis*, the most oligotrophic form, supported this conclusion. Furthermore, mathematical indices, including diversity, the community competition coefficient, and carrying capacity, separated urban inshore from rural inshore waters, further evidence of perturbation. Biomass estimates made with new acoustical techniques indicated that most of the zooplankton biomass was in deep waters, thus the eutrophication of Ontario's waters, both nearshore and in the vicinity of cities, is still localized in nature. Mathematical techniques have been developed to model such perturbations.

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CONTENTS

Sections		Page
I	Conclusions and Recommendations	1
II	Introduction	3
III	Methods	5
IV	Analysis of Zooplankton Populations	10
V	Effects of Urban Centers on Zooplankton Biomass	30
VI	Acoustical Estimates of Zooplankton Biomass	40
VII	Comparative Mathematics Analysis of Zooplankton Communities	64
VIII	A Hypothesis on Calanoid Succession to Cladocerans During Eutrophication	71
IX	References	78
X	Appendices	83

FIGURES

No. Page

1 Design of a continuous-efficiency net calibrator. 7

2 Filtering efficiency with depth for 3 vertical tows (100 m - 0 m, 50 m - 0 m and 25 m - 0 m) made in Lake Ontario. 8

3 Density (no./m^3) of eutrophic Cladoceran *Bosmina longirostris* on 21 - 25 August 1972 in surface waters (0 - 5 m) of Lake Ontario at 60 stations of IFYGL Biology Program. 17

4 Density (no./m^3) of oligotrophic *Bosmina coregoni* on 21 - 25 August 1972 in surface waters (0 - 5 m)... 19

5 Density (no./m^3) of eutrophic *Daphnia retrocurva* on 21 - 25 August 1972 in surface waters (0 - 5 m)... 20

6 Density (no./m^3) of ultra-oligotrophic *Diaptomus sicilis* on 10 - 14 July 1972 in surface waters (0 - 5 m)... 21

7 Density (no./m^3) of mesotrophic *Diaptomus minutus* on 12 - 16 June 1972 in surface waters (0 - 5 m)... 22

8 Density (no./m^3) of Cyclopoid copepodites on 21 - 25 August 1972 in surface waters (0 - 5 m)... 24

9 Density (no./m^3) of *Cyclops bicuspidatus* on 10 - 14 July 1972 in surface waters (0 - 5 m)... 25

10 Density (no./m^3) of *Cyclops vernalis* on 21 - 25 August 1972 in surface waters (0 - 5 m)... 26

11 Density (no./m^3) of *Tropocyclops prasinus* on 3 October 2 November 1972 in surface waters (0 - 5 m)... 27

12 Lake Ontario, divided into three areas of differing trophy and community structure... 32

13 Relationship between backscattering strength and size of spherical particles for five frequencies... 41

14 Regression of zooplankton biomass (g. dry wt/m^3) against acoustical reflectivity (D.C. volts/m^3), made from actual samples and acoustical profiles collected simultaneously on Lake Ontario. 48

FIGURES (CONTINUED)

No.		Page
15	Relative biomass (%) per 5 m interval versus depth (m) for 21 - 25 August 1972, 30 October - 3 November 1972, and 12 - 16 June 1973.	53
16	Column biomass (g dry wt/m^2) during August 1972.	56
17	Column biomass (g dry wt/m^2) during February 1973.	59
18	Column biomass (g dry wt/m^2) during June 1973.	62
19	Filtering rate compared to food concentration for *Daphnia* and *Diaptomus* and ingestion rates at these same food concentrations.	75

TABLES

Table		Page
1	Inshore zooplankton population densities.	12
2	Offshore zooplankton population densities.	14
3	Comparison of areas under stress with oligotrophic areas on basis of relative densities of *Diaptomus sicilis* + *minutus* and *Bosmina longirostris*.	29
4	Comparative mean densities of crustacean zooplankton from 0 - 5 m depth, contrasting urban inshore versus offshore community composition.	33
5a	Big Cities (inshore) community structure.	35
5b	Inshore (less Big Cities) community structure.	36
6	Offshore community structure.	37
7	Analysis of variance (2 - way ANOVA) for effect of location and time on density, community competition coefficient, etc.	38
8	Correction factors for acoustical returns necessary to equate returns to biomass of zooplankton.	42
9a	Example of uncorrected acoustical reflectivity at four frequencies over 100 channels of 1% depth increments. Lake Ontario, Station 17, August 1972.	44
9b	Corrected acoustical profiles.	45
9c	Differences between reflectivities at adjacent frequency envelopes (120 - 80 kHz, 200 - 120 kHz, and 500 - 200 kHz).	46
9d	Three profiles at constant 5 m intervals.	47
10	Acoustical reflectivity for three frequency envelopes for 21 - 25 August 1972.	50
11	Mean acoustical reflectivity and relative biomass.	51
12	Acoustical reflectivity, estimated column biomass, column volume, and biomass per unit volume for all stations, August 1972.	54

TABLES (CONTINUED)

Table		Page
13	Acoustical reflectivity, estimated column biomass, column volume and biomass per unit volume for all stations, Lake Ontario, February 1973.	58
14	Acoustical reflectivity, estimated column biomass, column volume, and biomass per unit volume for all stations, June 1973.	60
15	Comparison of acoustical biomass estimates over 0 - 50 m column, with those of Watson (1974).	63
16	Growth characteristics and a grazing estimate for hypothetical populations of zooplankton in an oligotrophic versus a mesotrophic lake.	73
17	Lakewide average of zooplankton densities.	84
18	Mean zooplankton population densities, 0 - 5 m.	86
19	Mean zooplankton population densities, 0 - 50 m.	88

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SECTION I

CONCLUSIONS AND RECOMMENDATIONS

The horizontal distribution of the crustacean zooplankton of Lake Ontario suggested that eutrophic indicator species were generally found in the vicinity of Metropolitan Toronto, the Oswego River, Mexico Bay, and Popham and Weller's Bays. The shallow bays of Lake Ontario likely represent areas of natural eutrophication, whereas conditions off Toronto and Oswego deserve special attention, as these areas of the lake are likely in a stage of accelerated cultural eutrophication (Section IV). Action in the near future is important to reverse eutrophication in these perturbed regions.

The impact of urban areas upon the crustacean zooplankton was also visible when using community matrix techniques to characterize watermasses. Zooplankton communities, considered together, showed greatest perturbation when in shallow waters near urban areas; correspondingly, least perturbation was associated with communities of deep waters (Section V). Thus the deepwater communities still contain important oligotrophic species vital to a stable community structure.

Biomass estimates made with new acoustical techniques indicated that previous estimates of zooplankton biomass were low (10 - 100 times), and that much of the biomass was associated with deep waters (>100 m). These conclusions will be important in modelling the Lake Ontario ecosystem (Section VI). They are both new and surprising, and require further confirmation.

The small cladoceran, Bosmina longirostris, has been described as a eutrophic indicator, likely because it utilizes a variety of algal foods, including larger phytoplankton and avoids fish predation (Section VIII). The ratio of B. longirostris to Diaptomus sicilis may be a useful indicator of perturbed communities (Section IV). This index is simple to determine, as the two species are easily recognized. Hopefully it will have future application in detailing areas of the Laurentian Great Lakes suffering from pollution.

New techniques developed for calibrating plankton nets indicated that samples collected with a 64μ mesh net over depth interval of 0 - 5 m may underestimate zooplankton abundance by a factor of 2x, while tows made over a path of 0 - 50 m may underestimate by a factor of 3x. These new results are vital to using historical data in calibrating and validating ecosystem models (Section III).

Mathematical techniques have been developed to model zooplankton communities, using new application of the community matrix. Eventual uses will include the development of simple mathematical indices for perturbed communities.

SECTION II

INTRODUCTION

The production of zooplankton in Lake Onatrio is closely related to environmental perturbations, including the input of plant nutrients and the introduction of exotic fishes. The principal purpose of this study, during The International Field Year on the Great Lakes, was to examine the abundance of zooplankton with regard to likely sources of nutrients and other perturbing factors, and then to evaluate the quality of this environment using the tools of modern ecology. These included both mathematical tools, such as expressions for community stability, as well as electronic devices such as our zooplankton-sensitive echo-sounder. With the results of this program now analyzed, we have a much better picture of specific regions along the shorelines of Lake Ontario where eutrophication is proceeding at an increased rate; in addition, it has been observed that even the deep-water communities sometimes exhibit signs of environmental instability.

In Section III we have listed the methods used, including traditional collection techniques with fine-meshed (64_{μ}) plankton nets, as well as acoustical methods for determining the total biomass of zooplankton in the water column. In addition, a detailed discussion of the collecting efficiency of nets has been included, with the result that we have suddenly realized that previous estimates of zooplankton biomass have been consistently low, by at least a factor of 2 and possibly by as much as one magnitude.

The seasonal distribution of the zooplankton crustaceans is important to modelling grazing and fish production. Detailed summaries for all ten cruises on Lake Ontario have been included in Section IV. In addition, horizontal distributions of all dominant species have been interpolated using the 60 station IFYGL grid. Analysis of these distributions, coupled with a subjective division of the crustacean zooplankton into oligotrophic and eutrophic indicators, has provided us with a detailed picture of the polluted regions of Lake Ontario, so that sources of plant nutrients may be identified and logical steps taken to reduce the rate of degradation of this vital ecosystem. One important function of this distribution analysis of the zooplankton is to identify in-basin sources of pollution, as opposed to perturbations resulting from the inflow of nutrients from Lake Erie.

Certainly urban concentrations of people, as well as industry and agriculture, are likely sources of nutrients and other perturbations. In the Lake Ontario basin most urban centers are also associated with rivers, whose mouths serve as natural harbors. In Section V we have examined the effects of urban centers and associated agricultural drainage upon inshore communities of zooplankton. Certainly the effects are most striking.

In modelling the trophic dynamics of a large ecosystem, not only are the fluxes of materials and energy difficult to quantify, but the standing crops of organisms are both difficult and time-consuming to estimate if traditional techniques of plankton sampling are employed. In Section VI we have presented our new acoustical method for the estimation of zooplankton biomass over the entire water column at each sampling station. The results suggest that others may have previously underestimated the abundance of zooplankton in Lake Ontario. These results will enable more realistic ecosystem models to be constructed, with a better understanding of the magnitude of zooplankton grazing.

Our estimates of the impact of urban areas upon water quality (Section V) utilize one form of the competition matrix to interpret community structure on a comparative basis. In Section VII Dr. Steven Levine has investigated community structure with a new modification of this matrix. This approach enables us to estimate community stability, or the relative lack thereof, again from information on species abundance.

The changes in the composition of the crustacean zooplankton in Lake Ontario, both on a geographical basis and with historical time, are certainly related to their trophic relationships, especially selective feeding upon certain algal forms. In Section VIII we have suggested a new hypothesis to explain these dramatic community changes occurring as Lake Ontario becomes more perturbed.

The appendix includes summaries of the zooplankton composition on each IFYGL cruise, as well as a selected sample of results (4 cruises), from using our acoustical device in estimating zooplankton biomass.

SECTION III

METHODS

GENERAL FIELD TECHNIQUES

Zooplankton net samples

Vertical plankton hauls were taken from the NOAA R/V Researcher at the 60 IFYGL sampling stations on the 10 IFYGL cruises. Fortunately these 60 stations selected by the IFYGL Management were comparable within the framework of our lakewide division, described in Sections V and VI. The urban inshore stations had a mean depth of 14.0 m, whereas those stations designated rural inshore had a mean depth of 18.5 m. Samples were collected from 5 m depth to the surface, 0 - 25, 0 - 50, 0 - 100, 0 - 150 and 0 - 200 m using a plankton net 0.8 m in diameter, with mesh apertures of 154 μ for cruises 1 - 3 and of 64 μ thereafter. The zooplankton in these samples were relaxed with CO_2, preserved in buffered formalin (pH 7.0), and counted in the laboratory. Approximately 3% of the most abundant forms in each sample were counted, whereas all of the rare species were tallied.* Thus we were able to discover 6 specimens of Diaptomus ashlandi obscurred among the first 300,000 animals identified to species!

Acoustical profiles

At each station four acoustical profiles were recorded, both on paper tape and on an X-Y plotter for immediate inspection. These profiles were made at frequencies of 80, 120, 200 and 500 kHz. The theory behind acoustical sampling, the program developed for data reduction, and actual examples of such data will be presented in Section VI and in the Appendix.

---

*Note: plankton densities used in analyses found in Sections IV and V are observed densities. That is, the number per unit volume (m^3) was determined from a consideration of the amount of water in a hypothetical column of a given depth and from a consideration of the number of animals captured in those waters. If corrected densities are required for modelling, multiply observed densities by 2.01 for samples from the 0 - 5 m strata. Likewise the data on density in the Appendix have not been adjusted. In calculating lakewide biomass (Section VI) the net efficiency was considered. Thus the densities of zooplankton and biomass estimates in Section VI are corrected for the inefficiency of net sampling. These data do not need to be adjusted.

PERFORMANCE OF ZOOPLANKTON NETS

Introduction

Our purpose was to design a meter to measure the efficiency of a plankton net in a continuous fashion. Vertical net-hauls remain a principal tool of many limnological investigators. In making such hauls the nets encounter successive water layers containing varying densities of organisms. With such encounters, a net becomes progressively more clogged. Thus a simple measure of total flow tells little, for the net could have an efficiency of 15 to 70% when a distinct layer is encountered. But a continuous measure will enable an investigator to tell precisely the efficiency at any point in the water column.

These measures of efficiency which we have made will be of considerable use. They suggest that standing crops of zooplankton in Lake Ontario are 2 - 5 times larger than previously anticipated.

Construction and Operation

Two plastic rotor assemblies (Fig. 1), consists of a propeller 10cm in length mounted upon a shaft, with a magnet mounted off-axis at the opposite end. Each time the shaft rotates, a magnetic switch is closed, thereby applying a signal to a magnetic tape recorder.

One rotor assembly was mounted 7.5 cm below the rim of a 3/4 m dia. net and 17 cm from the rim. The other rotor was mounted 15 cm outside the rim. The electronics were mounted in a sealed pipe 12 cm in diameter, which served also as a weight. It was easily sealed to withstand pressures to 150 m.

The electronics consisted of two free-running multi-vibrators operating at widely different frequencies. The magnetic switch, closing at a rate of once per revolution, is registered on a magnetic tape. The information was stored on the magnetic tape. It was made by transcribing the tape slowly (1/15 original) into a recording potentiometer. One may visibly separate the two frequencies and thus count the number of times the magnetic switches closed.

Results of field-trial

A 3/4 m dia. net with mesh aperture of 64u was calibrated on Lake Ontario. The net was lowered to 25, 50 and 100 m and raised to the normal speed (slow) of a B.T. winch.

The results (Fig. 2) show a curvilinear decrease in filtering efficiency. Whether the net was lowered to 25 or 100 m depth, initially the efficiency was 65 - 70%. In each case the efficiency had dropped to 15 - 30 % by the time it reached the surface. Nets fished only in the trophogenic zone showed a steeper rate of decrease

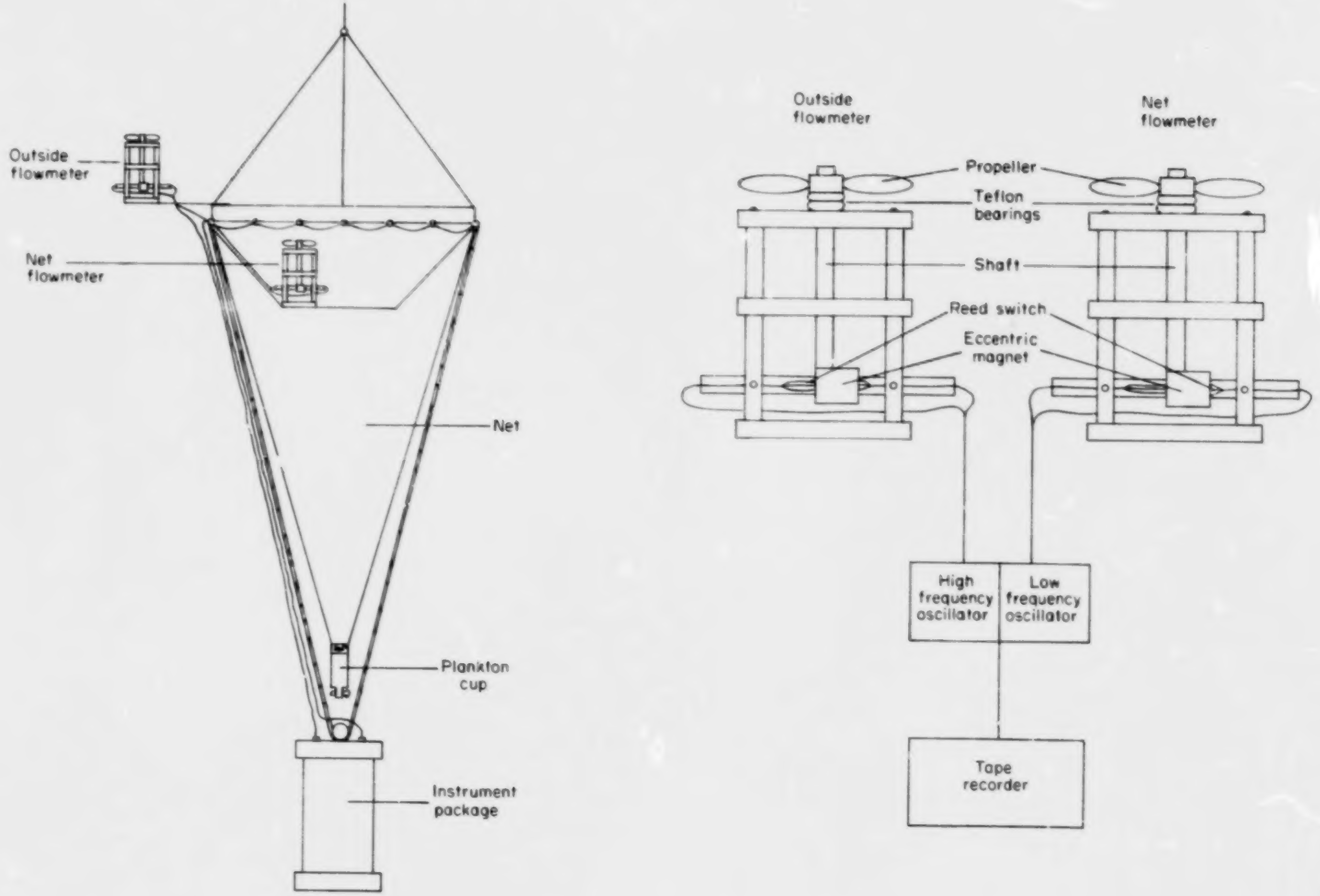

Figure 1. Design of a continuous-efficiency net calibrator

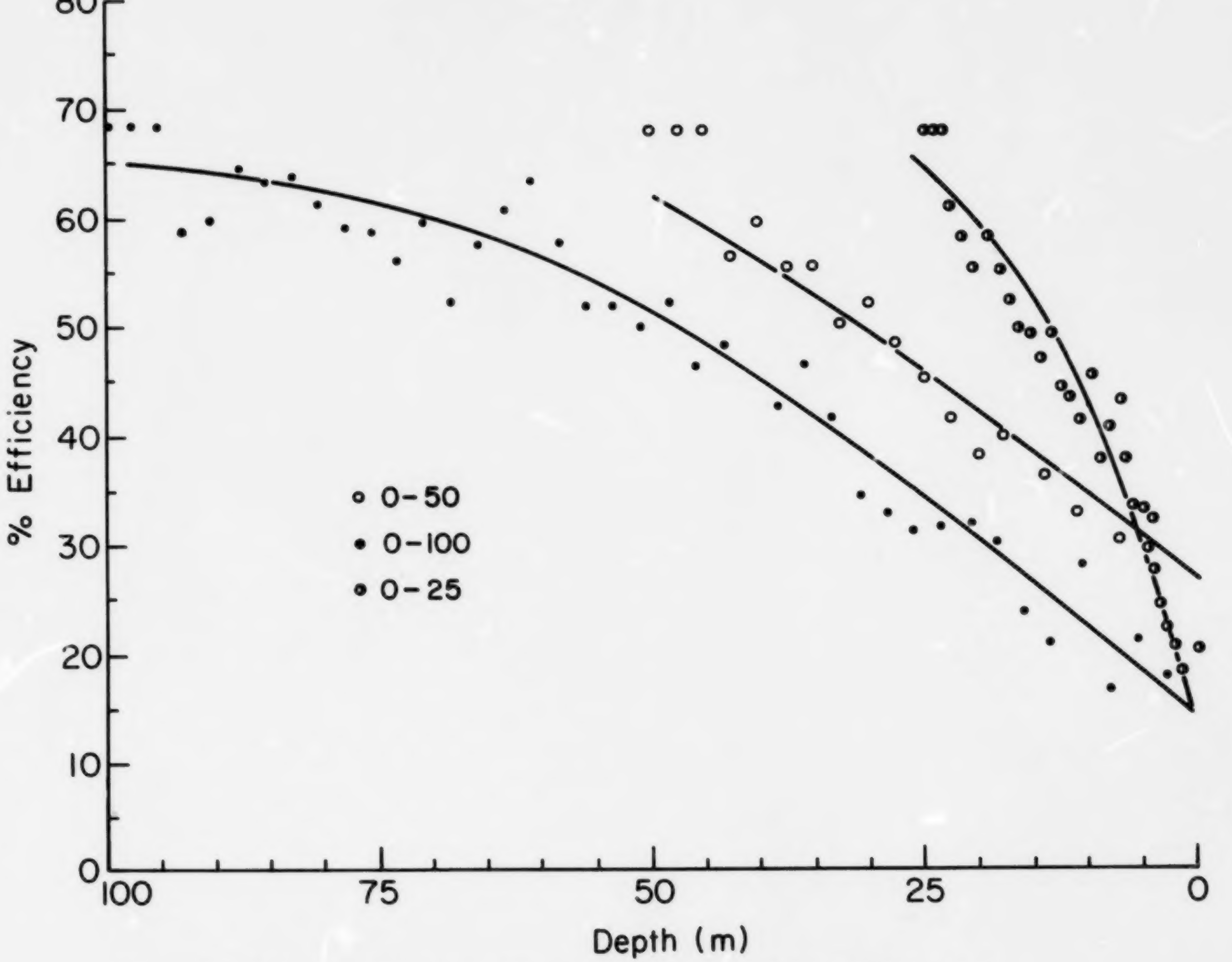

Figure 2. Filtering efficiency with depth for 3 vertical tows (100 m - 0 m, 50 m - 0 m, and 25 m - 0 m) made in Lake Ontario.

(0 - 25 m tow) than nets fished in deeper, less productive waters (0 - 100 m). In any case, without such a device, it obviously is impossible to predict the efficiency of a net at the moment it encounters a layer of plankton.

Recommendations

Devices are currently available, such as high-frequency sonar, which graphically delimit layers of zooplankton (see Part VI). Combined with such graphic devices, a net equipped with the device described herein is a logical companion, permitting precise estimates of net efficiency at any level during a vertical tow.

SECTION IV

ANALYSIS OF ZOOPLANKTON POPULATIONS

Both seasonal patterns in species abundance and estimates of secondary productivity are important in understanding the dynamics of competing species, let alone relating their dynamics to that of the primary producers. We have produced detailed information on the abundance of all species of Cladocera and Copepoda (Crustacea) at the 60 stations of the IFYGL Lake Ontario grid. Estimates of standing crop are vital in estimating zooplankton grazing. Horizontal distribution is important to understanding the development of populations, with regard to the non-homogeneous or clumped distribution of their food resources.

SEASONAL DISTRIBUTION OF THE CRUSTACEA

Bosmina longirostris, the most abundant cladoceran of Lake Ontario, began to increase in abundance in April and May in *inshore* waters, although rapid population growth does not result in large standing crops until June (Table 1). Maximum densities were reached in August inshore. In deeper, offshore waters, the initial standing crops were lower in May and June, but July and August densities were as high as 63,691/m^3 (Table 2). Following a population crash in November, *Bosmina* over-wintered as parthenogenetic females, at densities of only 0.3-10.2/m^3.

Bosmina coregoni, a larger Bosminid considered characteristic of oligotrophic waters (see Section VIII), is also found in Lake Ontario. It likewise overwinters at densities of 4 - 65/m^3, but is currently much less successful in Lake Ontario, reaching a maximum density of 2,050/m^3 offshore in October (Table 2).

Among the daphnids, *Daphnia retrocurva* is currently most successful in epilimnetic waters, again with an August maximum (11,965/m^3) offshore (Table 2). The smaller *Ceriodaphnia lacustris* is chiefly a summer form, as is *Holopedium gibberum*. *Diaphanosoma* sp. is a winter form, in relatively low numbers (4 - 9/m^3) from November through March (Table 2).

Polyphemus pediculus, a non-bivalve cladoceran often considered predatory, is found only during August in offshore waters (Table 2).

Cyclops bicuspidatus was the most common cyclopoid of the offshore waters, whereas *Tropocyclops prasinus* was more common inshore (Table 2). *C. bicuspidatus* was most abundant during July and August (12,478/m^3), and overwintered at high densities (121-452/m^3) in offshore waters (Table 2). *C. vernalis* likewise reached its maximum abundance in

August, but never exceeded densities of 650/m^3. *Tropocyclops* is an autumnal species, which reached densities of 14,185/m^3 offshore at the same time. Thus not only do *C. bicuspidatus* and *T. prasinus* show different seasonal patterns, but their gross horizontal distribution, to be examined further, is complimentary.

The calanoid copepods, often abundant in oligotrophic waters, are a diverse assemblage in Lake Ontario, but are never especially abundant. Unidentified copepodites were most abundant inshore during October-November. The classical oligotrophic indicator, *Diaptomus sicilis*, was most abundant offshore in June (184/m^3) and July (119/m^3). *Eurytemora affinis*, the recent invader from the sea, never exceeded 2350/m^3 (August) in inshore waters (Table 1).

These data on relative density clearly indicate that Lake Ontario is characterized by a single seasonal peak in zooplankton production which occurs during August. Most species overwinter in the lake as adults, the exceptions being the rare cladocerans, *Holopedium*, *Polyphemus* and *Diaphanosoma*.

Table 1. INSHORE ZOOPLANKTON POPULATION DENSITIES. Values (number/m^3) represent animals collected with net (64 u aperture) at stations in waters less than 30 m in depth, over vertical range of 0 - 5 m.

Species	15-19 May	12-16 June	10-14 July	21-25 Aug	Oct-Nov	Nov-Dec	5-9 Feb	19-23 Mar	24-28 April	12-16 June
Cladocera										
Bosmina coregoni	13.4	62.2	2040.	547.	3628.	1246.	64.5	62.7	20.5	152.
Bosmina longirostris	41.4	887.	9844.	97,741.	2073.	126.4	8.8	3.5	10.2	2723.
Daphnia galeata	0.5	23.8	78.6	299.	24.8	56.8	13.1	1.9	6.1	12.3
Daphnia retrocurva	0.	22.8	86.0	8676.	2331.	689.	8.7	2.4	8.5	39.5
Daphnia longiremis	0.	0.3	0.3	0.	30.3	0.	0.	0.	5.2	6.0
Ceriodaphnia lacustris	0.	0.5	101.	3989.	138.	4.9	0.	0.	13.6	27.1
Chydorus sphaericus	0.1	19.7	94.4	358.	70.	610.	0.	1.5	12.0	26.3
Holopedium gibberum	0.	0.7	0.	30.	4.5	0.	0.	0.	0.	0.
Polyphemus pediculus	0.	0.	0.	4.	0.	0.	0.	0.	0.	0.
Diaphanosoma	0.	0.	0.	20.	3.8	14.0	0.	9.0	0.	0.
Cyclopoida										
Cyclopoid copepodites	132.0	418.	1193.	21,552.	11,003.	7532.	1893.	1145.	1341.	17482.
Cyclops bicuspidatus	170.1	534.	5818.	4274.	932.	723.	145.	184.	1363.	639.
Cyclops vernalis	0.7	25.7	146.	881.	262.	129.	8.3	11.6	11.0	203.

Table 1 (continued). INSHORE ZOOPLANKTON POPULATION DENSITIES. Values (number/m^3) represent animals collected with net (64 u aperture) at stations in waters less than 30 m in depth, over vertical range of 0 - 5 m.

Species	15-19 May	12-16 June	10-14 July	21-25 Aug	Oct-Nov	Nov-Dec	5-9 Feb	19-22 Mar	24-28 April	12-16 June
Cyclopoida (cont)										
Tropocyclops prasinus	0.5	25.6	247.	2000.	14,185.	1278.	189.5	53.5	65.1	140.
Mesocyclops	-	-	+	++	+	-	-	-	-	+
Calanoida										
Calanoid copepodites	0.8	68.8	209.	148.	494.	218.	45.4	63.4	122.7	266.
Diaptomus ashlandi	28.4	-	-	0.	-	11.3	0.	15.9	-	-
Diaptomus siciloides	0.	0.	0.	0.2	21.9	13.0	7.0	2.1	1.5	6.0
Diaptomus minutus	0.	50.3	84.4	49.		43.3	33.7	45.5	37.8	228.
Diaptomus oregonensis	0.7	25.4	105.	17.5	60.9	90.3	71.5	13.4	43.8	6.8
Diaptomus sicilis	12.7	39.8	117.	8.8	63.3	54.4	41.0	39.3	39.0	14.9
Limnocalanus macrurus	59.6	309.	88.7	8.0	33.7	38.9	40.2	52.2	124.7	38.0
Eurytemora affinis	0.	16.8	0.	2350.	161.3	28.2	3.0	0.	22.6	16.1

Table 2. OFFSHORE ZOOPLANKTON POPULATION DENSITIES. Values (number/m^3) represent animals collected with net (64 u aperture) at stations in waters greater than 30 m in depth, over vertical range of 0 - 5 m.

Species	15-19 May	12-16 June	10-14 July	21-25 Aug	Oct-Nov	Nov-Dec	5-9 Feb	19-22 Mar	24-28 April	12-16 June
Cladocera										
Bosmina coregoni	0.5	31.3	389.	1453.	2050.	751.	11.0	4.4	5.8	66.1
Bosmina longirostris	28.	288.	13206.	63,691.	1784.	75.4	0.3	1.2	2.1	972.2
Daphnia galeata	0.4	22.2	3027.	99.	13.6	8.5	0.	0.2	0.	0.9
Daphnia retrocurva	0.	15.9	149.	11,965.	1733.9	66.7	0.	0.	0.1	25.7
Daphnia longiremis	0.	0.	294.	0.	0.7	0.2	0.	0.	0.	0.2
Ceriodaphnia lacustris	0.	0.7	103.	4202.	149.8	59.6	0.	0.	0.5	6.7
Chydorus sphaericus	0.	16.0	641.	100.	33.5	0.7	0.	0.	0.	5.9
Holopedium gibberum	0.	0.	53.9	7.	1.5	0.	0.	0.	0.	0.
Polyphemus pediculus	0.	0.	0.	3.	0.	0.	0.	0.	0.	0.
Diaphanosoma	0.	0.	0.	2.5	0.3	0.	0.	0.	0.	0.
Cyclopoida										
Cyclopoid copepodites	86.7	322.	2201.	29,143.	10,803.	6820.	2260.	1600.	664.	9674.
Cyclops bicuspidatus	344.	1424.	12,478.	12,113.	1182.	345.9	121.0	268.	452.	538.5
Cyclops vernalis	0.7	28.1	190.	643.	132.	131.	13.2	4.9	0.9	34.9

Table 2 (continued). OFFSHORE ZOOPLANKTON POPULATION DENSITIES. Values (number/m^3) represent animals collected with net (64 u aperture) at stations in waters greater than 30 m in depth, over vertical range of 0 - 5 m.

Species	15-19 May	12-16 June	10-14 July	21-25 Aug	Oct-Nov	Nov-Dec	5-9 Feb	19-22 Mar	24-28 April	12-16 June
Cyclopoida (cont)										
Tropocyclops prasinus	0.	10.8	65.6	1676.	3510.	886.7	159.8	159.	257.5	287.9
Mesocyclops	-	+	+	++	+	+	-	-	-	-
Calanoida										
Calanoid copepodites	19.9	60.4	123.9	116.	331.	128.3	36.6	72.4	94.5	155.6
Diaptomus ashlandi	0.	0.	0.	0.	0.	0.	0.8	0.	0.	0.
Diaptomus siciloides	0.	0.	0.	0.	2.5	5.2	0.3	0.	0.	0.6
Diaptomus minutus	56.7	225.	90.9	73.7	27.8	28.6	42.8	54.4	50.6	47.3
Diaptomus oregonensis	0.8	70.7	76.1	107.5	35.8	34.5	9.3	6.2	10.7	1.9
Diaptomus sicilis	22.4	184.	119.4	17.	26.1	28.3	27.4	24.5	44.8	2.5
Limnocalanus macrurus	68.2	183.	139.	6.	23.8	22.9	20.4	50.8	127.0	1.4
Eurytemora affinis	0.	0.	0.	117.6	110.1	22.6	0.3	0.	9.5	1.4

HORIZONTAL DISTRIBUTION OF CRUSTACEAN ZOOPLANKTON AT SPECIES POPULATION MAXIMA

Water quality is reflected in the horizontal distribution of the crustacean zooplankton of Lake Ontario. From our sampling during the 1972-73 IFYGL survey, the distributions of each species are available from a variety of water strata. In this section we will discuss the horizontal surface (0 - 5 m) distribution of dominant forms at the time of their seasonal population maxima.

Biologically it is important to interpret horizontal distributions. Inputs of plant nutrients from rivers tributary to Lake Ontario likely influence secondary production. Thus areas of unusually high standing crops of zooplankton are likely indicators of stimulation by pollutants of the nutrient-poor Ontario ecosystem. Likewise, physical factors like upwelling, with associated increases in available plant nutrients, may influence observed horizontal distributions of zooplankton. In the final interpretation of Lake Ontario results, such information must be considered.

Lastly, the Ontario ecosystem is extremely dynamic. Large populations of warm-water cladocerans, initially developing inshore, may be carried offshore, with little final correspondence between the location of a clump in time and the environmental factors which led to its development.

The Cladocera

The horizontal distributions of the cladoceran and copepod crustaceans will be discussed as a sequence of possible eutrophic indicators from Bosmina longirostris, the most useful key to extreme eutrophy, to Diaptomus sicilis, the most primitive oligotrophic form.

The smallest major cladoceran, Bosmina longirostris, is likely a eutrophic indicator because of its diet, which permits grazing on large forms of algae. It is predominantly an inshore form (Section V), presently close to urban centers. Bosmina longirostris was found in Ontario over 12 months, but reached maximum density during August 1972. Clearly the horizontal distribution of B. longirostris is (a) characterized by greater densities inshore, and (b) associated with urban shoreline development and river inflow. At maximum development from 21 - 25 August 1972, it reached densities of greater than 200,000/m^3 off Toronto, Ontario, and 300,000 off Oswego, New York (Figure 3). Likely the Oswego case was influenced as much by the agricultural nutrient load of the Oswego River as by the city itself, whereas the effect from Toronto is likely more directly associated with nutrients originating from the city. In both cases, of course, such nutrient stimulation is thought to have its primary impact upon the phytoplankton, with the response which we have observed so clearly in the zooplankton

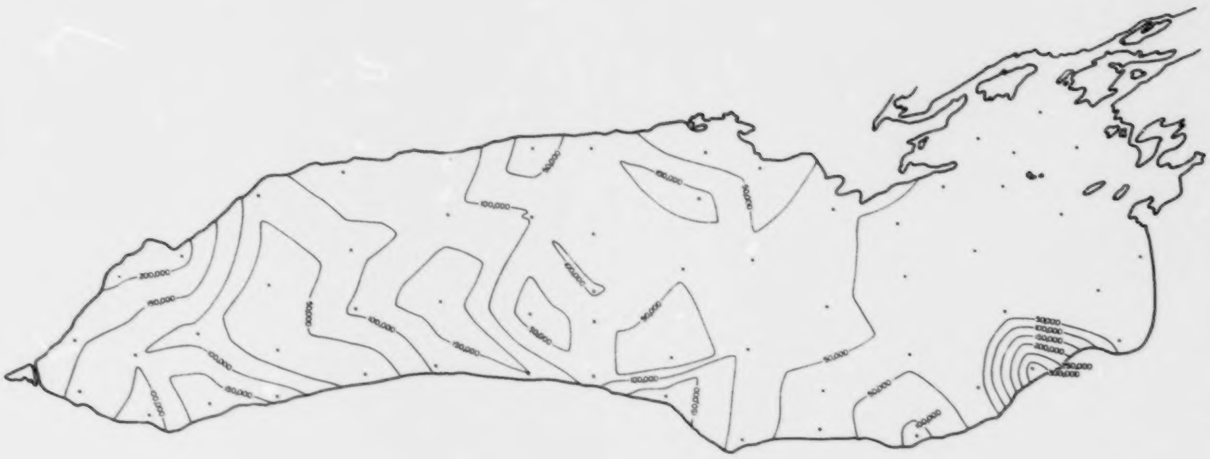

Figure 3. Density (no./m^3) of eutrophic Cladoceran Bosmina longirostris on 21 - 25 August 1972 in surface waters (0 - 5 m) of Lake Ontario at 60 stations of IFYGL Biology Program

a secondary one. But the usefulness of *Bosmina longirostris* as an indicator of stress is obvious.

Bosmina coregoni, almost twice as large as *B. longirostris* at maturity, has been considered an oligotrophic form. In contrast to the inshore preferences of *B. longirostris*, *B. coregoni* exhibited offshore blooms of up to 30,000/m^3, also during 21 - 25 August 1972. These intense concentrations were largely confined to the eastern end of Lake Ontario (Figure 4), with large aggregations of 20,000/m^3 and 1,500/m^3 offshore of Rochester, New York, and a cell of lesser density at the outflow of the lake.

The third common cladoceran, *Daphnia retrocurva*, while not classically used as an indicator of eutrophication, is a small species which withstands fish predation well, and thus is very successful. Large inshore concentrations were found again at Oswego (35,000/m^3) and just eastward from Oswego at Nine Mile Point (10,000/m^3), the site of a nuclear power plant complex from 21 - 25 August 1972. A third cell of maximum densities of 20,000/m^3 was located west of Rochester (Figure 5).

The Copepods

Diaptomus sicilis, in sharp contrast to the cladoceran *Bosmina longirostris*, is the most oligotrophic form in the Great Lakes, and remains the dominant species in oligotrophic Lake Superior. As expected of an oligotrophic indicator, it develops its maximum population earlier (July) than *Bosmina longirostris* (August), and this development occurs in deeper, cooler midlake watermasses. Currently not nearly as abundant as *Bosmina*, *D. sicilis* densities during 1972 did not exceed 375/m^3. Two large cells were found in eastern Lake Ontario (Figure 6), one occupying most of the deepwater basin north of Rochester and Oswego, and the other between this larger cell and the outlet during the period 10 - 14 July 1972. Less intense inshore development was observed in shallow Mexico Bay in the extreme southeast corner of the lake and in the western portion just east of the Niagara River inflow.

Diaptomus minutus, a more mesotrophic species with the predatory avoidance characteristics associated with small size at maturity, also exhibited an offshore distribution at maximum development. Large clumps with relatively low densities of 300 - 1000/m^3 were found in both the western and eastern parts of Lake Ontario from 12 - 16 June 1973. In contrast to the cladocerans, these cells were always centered well offshore (Figure 7).

The cyclopoid copepods have not been used as indicators of pollution in the traditional sense. They are likely predators which obtain a living by piercing and sucking body fluids from rotifers and small crustaceans. Three species are dominant in Lake Ontario. In order of abundance, these are *Cyclops bicuspidatus*, *C. vernalis* and *Tropocyclops prasinus*. *Cyclops bicuspidatus* reached its population maximum in July, *C. vernalis* in August, and *Tropocyclops* in October 1972.

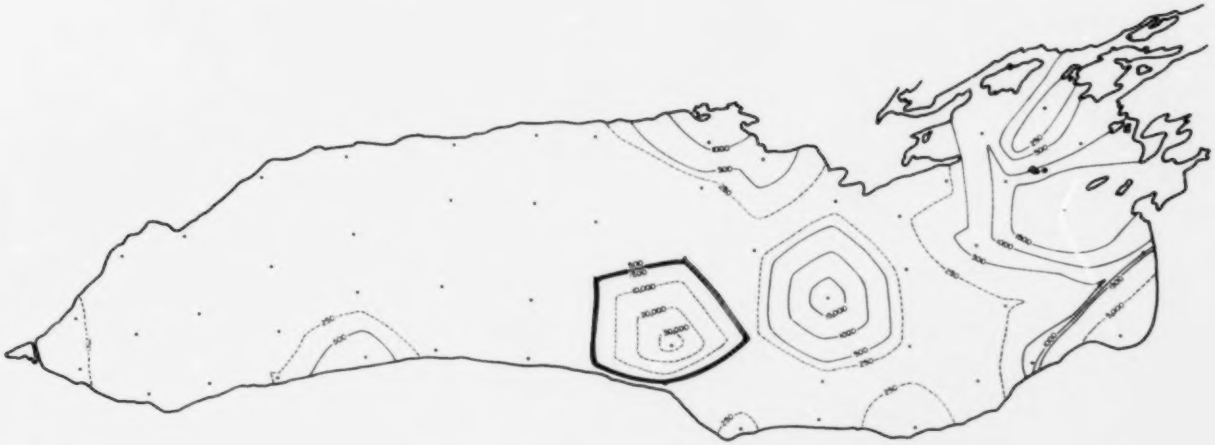

Figure 4. Density (no./m^3) of oligotrophic Bosmina coregoni on 21 - 25 August 1972 in surface waters (0 - 5 m) of Lake Ontario at 60 stations of IFYGL Biology Program

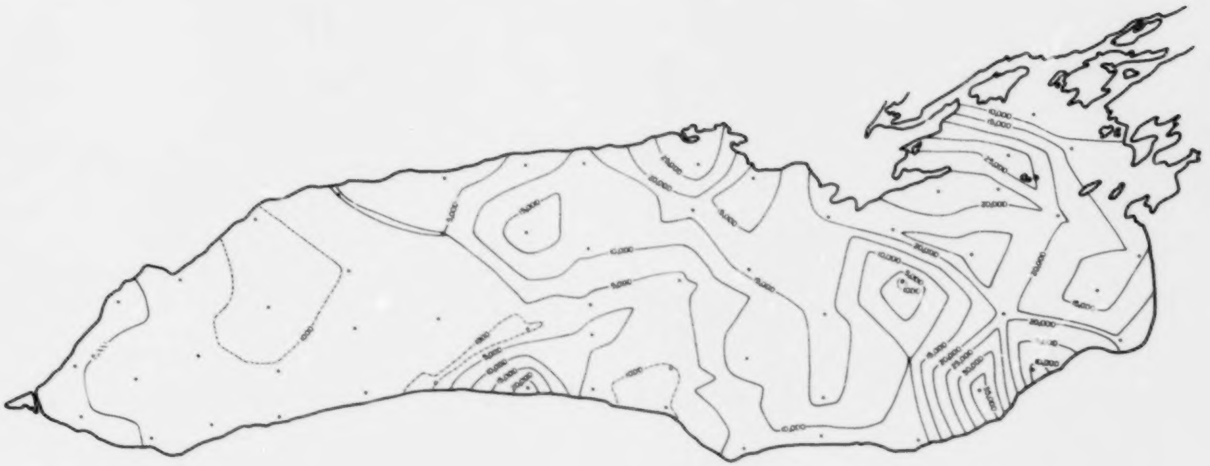

Figure 5. Density (no./m^3) of eutrophic Daphnia retrocurva on 21 - 25 August 1972 in surface waters (0 - 5 m) of Lake Ontario at 60 stations of IFYGL Biology Program

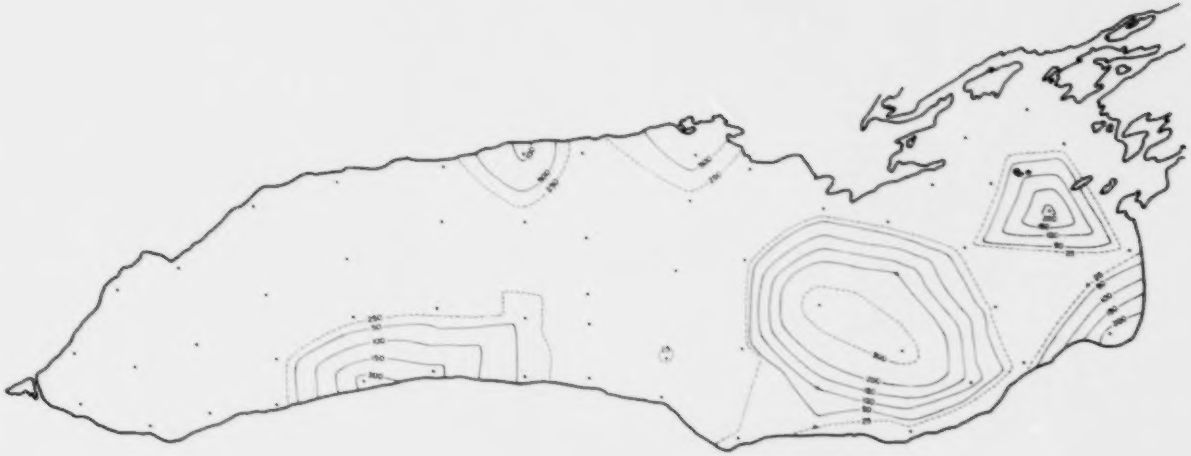

Figure 6. Density (no./m^3) of ultra-oligotrophic Diaptomus sicilis on 10 - 14 July 1972 in surface waters (0 - 5 m) of Lake Ontario at 60 stations of IFYGL Biology Program

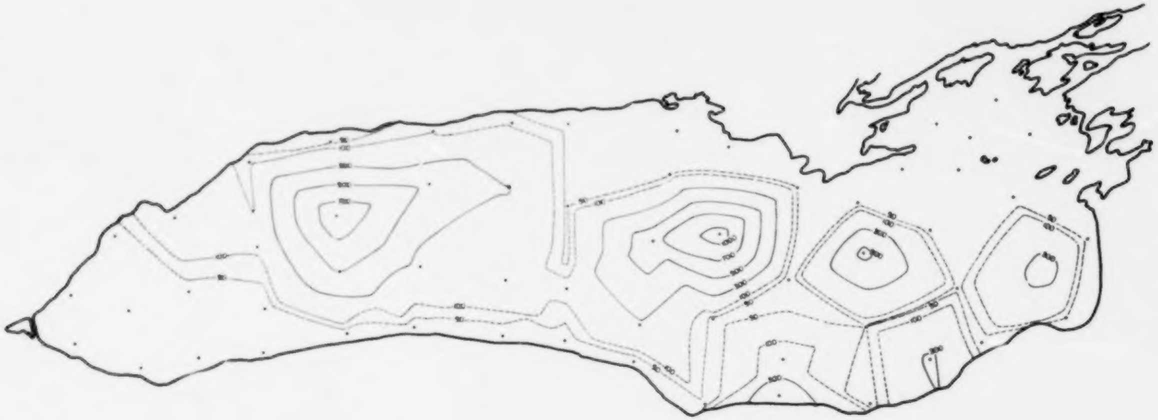

Figure 7. Density (no./m^3) of mesotrophic Diaptomus minutus on 12 - 16 June 1972 in surface waters (0 - 5 m) of Lake Ontario at 60 stations of IFYGL Biology Program

Cyclopoid copepodites, or immatures of the above three species, were abundant from 21 - 25 August 1972, both inshore and offshore (Figure 8). A large cell with maximum densities of 50,000/m^3 was present in shallow eutrophic Mexico Bay in southeast Lake Ontario, but the greatest concentrations were in the central basin of the lake (100,000/m^3) and inshore just southwest of Toronto (90,000/m^3). Cyclopoids develop rather slowly, and it is likely that large aggregations may drift about the lake for long periods of time with little relationship to the origin of the underlying environmental factors responsible for their initial population explosion.

Cyclops bicuspidatus, the most abundant of the cyclopoid copepods, is a spring species reaching a maximum abundance by early (10 - 14) July. In eastern Lake Ontario it was most abundant over deepwater at Station 75 (20,000/m^3). In the western waters a large cell was located in midlake (70,000/m^3) and another inshore at Toronto (50,000/m^3). The density of *Cyclops* in the inflowing waters from Lake Erie was apparently rather low (10,000/m^3), as illustrated in Figure 9. Since *Cyclops* is a seizer and serum sucker probably feeding upon rotifers and small crustaceans, its distribution may reflect the abundance of such foods, but is likely less closely tied to algal and nutrient distributions and thus is not useful as an indicator of environmental stress.

Cyclops vernalis was much less abundant than *C. bicuspidatus*. Two small concentrations were observed in western Lake Ontario during August (Figure 10), one off of Toronto (1500/m^3), from 21 - 25 August 1972. Elsewhere densities ranged between 250 and 1500/m^3. Together with the data on *C. bicuspidatus*, these densities of *C. vernalis* may enable modellers to estimate the incidence of zooplankton (non-fish) predators.

Tropocyclops prasinus is an autumnal form which reached densities of 335,000/m^3 during October 1972 (Figure 11). It was found in a very large inshore bloom (200,000/m^3) west of the Murray Canal, which connects the Bay of Quinte to Lake Ontario, from 30 October through 3 November 1972. The relationship of such blooms in Popham's Bay to nutrient inputs from the Bay of Quinte should be answered.

Generalities Regarding the Horizontal Distribution of the Crustacean Zooplankton

Certainly the cladocerans are most abundant close to shore, while the copepods prefer deeper waters. These data illustrate differences within these two orders, indicating clearly that some cladocerans prefer more eutrophic conditions than others, while some copepods are more oligotrophic than others. *Bosmina longirostris*, clearly the most eutrophic form, exhibits a tendency to explode in areas of known perturbation, especially off the Oswego River and the City of Toronto. *Bosmina coregoni*, a more oligotrophic indicator on a relative scale, is found in large offshore clumps, well away from major sources of inorganic and organic plant nutrients. *Daphnia retrocurva* is

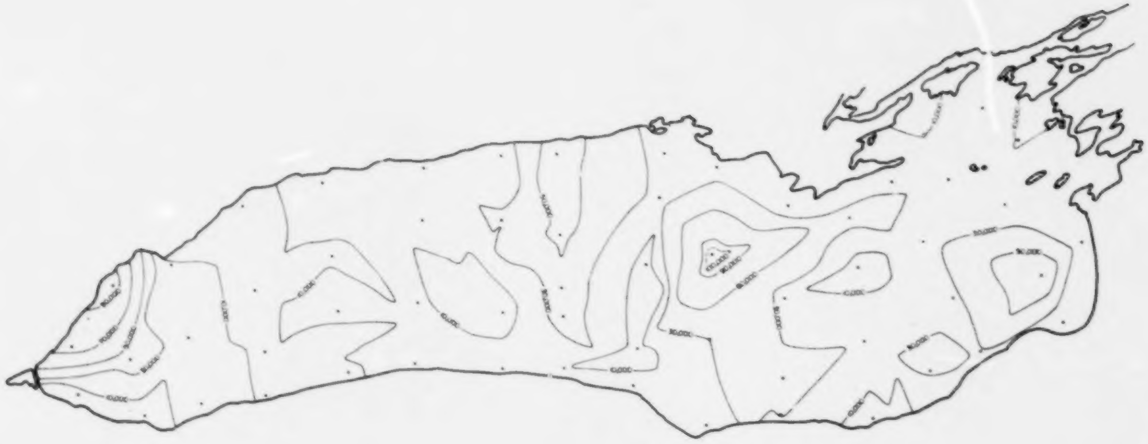

Figure 8. Density (no./m^3) of Cyclopoid copepodites on 21 - 25 August 1972 in surface waters (0 - 5 m) of Lake Ontario at 60 stations of IFYGL Biology Program

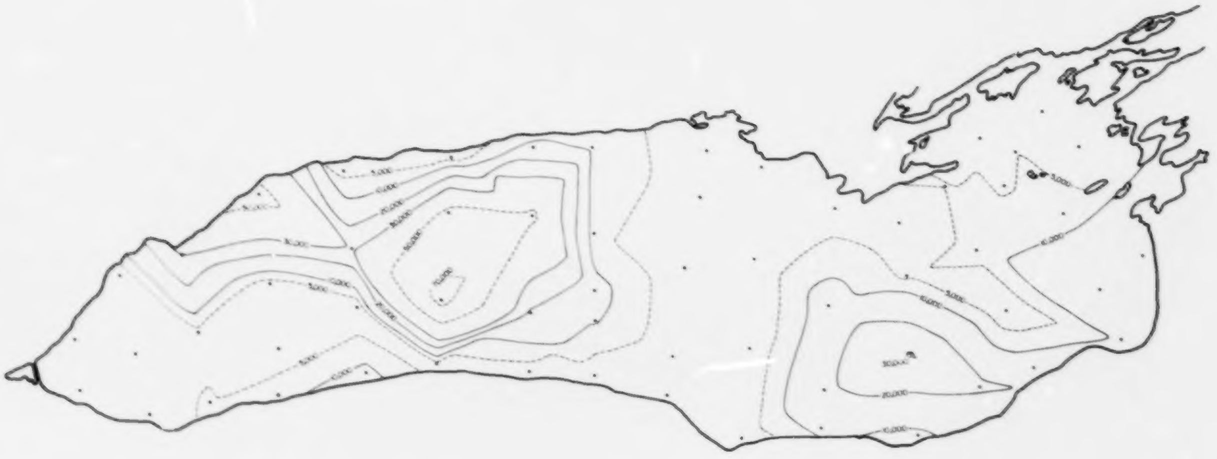

Figure 9. Density (no./m^3) of Cyclops bicuspidatus on 10 - 14 July 1972 in surface waters (0 - 5 m) of Lake Ontario at 60 stations of IFYGL Biology Program

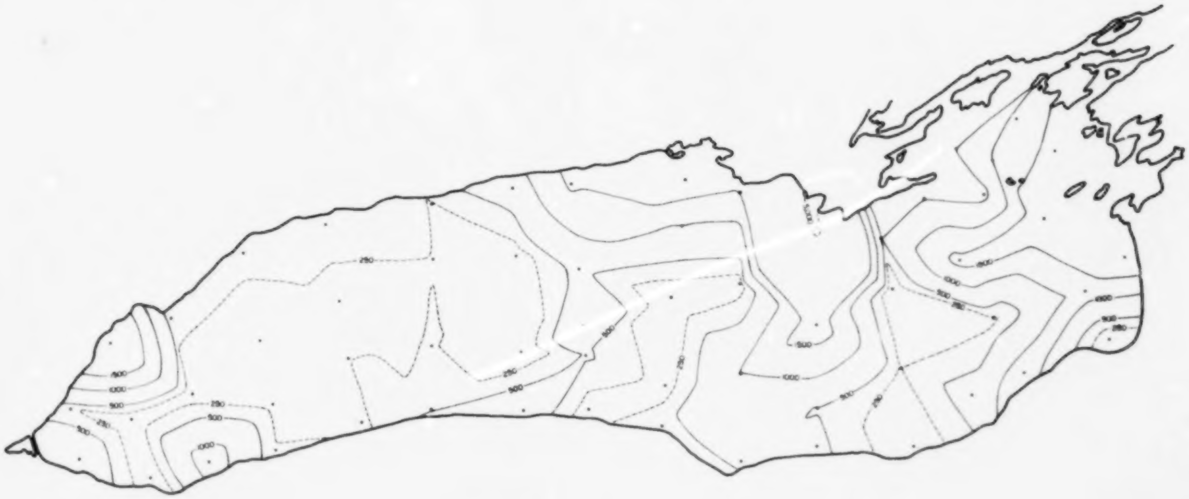

Figure 10. Density (no./m^3) of Cyclops vernalis on 21 - 25 August 1972 in surface waters (0 - 5 m) of Lake Ontario at 60 stations of IFYGL Biology Program

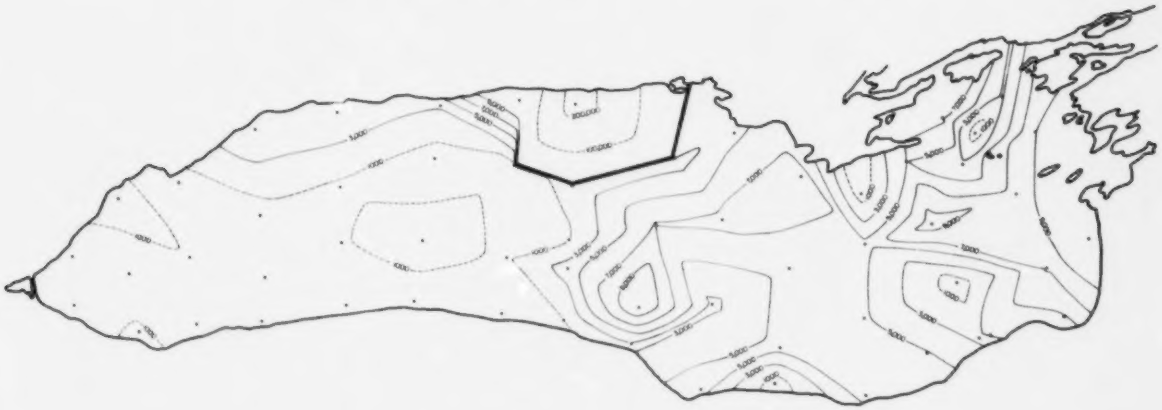

Figure 11. Density (no./m^3) of Tropocyclops prasinus on 30 October - 3 November 1972 in surface waters (0 - 5 m) of Lake Ontario at 60 stations of IFYGL Biology Program

intermediate between the Bosminas in its response, probably closer to *B. longirostris*.

Clearly *Diaptomus sicilis*, often called the most oligotrophic crustacean, exhibits an offshore distribution, as does *Diaptomus minutus*. From our observation, strongly influenced by information in the literature, we have erected a continuum of species, indicative of early oligotrophy to eutrophy. For these found in Lake Ontario, the extremes might include:

Early oligotrophy:	*Diaptomus sicilis*
Oligotrophy:	*Bosmina coregoni*
Mesotrophy:	*Diaptomus minutus*
Eutrophy:	*Daphnia retrocurva*
Late Eutrophy:	*Bosmina longirostris*

Communities of Lake Ontario Under Stress

Four restricted areas of this tremendously large system are currently under stress, as indicated by their zooplankton communities. These include the waters adjacent to Metropolitan Toronto, those off the Oswego River, and three shallow and productive Bays, Mexico Bay in southeast Lake Ontario and Popham's and Weller's Bays adjacent to the Murray Canal which connects Lake Ontario to the Bay of Quinte on the northeastern Canadian shore.

We have concluded that these areas are under stress, based on a consideration of the relative numbers of cladocerans and calanoid copepods found at maximum density, usually during July and August. In the four areas under stress, the mean density of *Bosmina longirostris* at population maximum was 150,000/m^3, while that for *Diaptomus sicilis* and *minutus* was 312/m^3, for a *Bosmina*:*Diaptomus* ratio of 480:1 (Table 3). In more oligotrophic waters at stations 17, 77 and 83, the mean density of *Bosmina* was 1000/m^3 and that of *Diaptomus* was 255/m^3, for a *Bosmina*:*Diaptomus* ratio of 3.9:1. Thus *Diaptomus*, the oligotrophic form, is relatively more abundant in oligotrophic waters as indicated. *Bosmina*, on the other hand, was 150 times more abundant in eutrophic than oligotrophic waters in this example.

Clearly, the Environmental Protection Agency should consider solutions to problems of accelerated eutrophication in U.S. territorial waters near Oswego and especially in Mexico Bay, and the Canadian government should be concerned with the same problem in the area of Toronto and in shallow Popham's and Weller's Bays on the northern coast of Lake Ontario. It may be possible to separate cultural causes from simple morphometric (depth) relationships in these cases. That is, the problems associated with the input of nutrients from the Oswego River and Toronto may have engineering or other technical solutions. The problems of high productivity in the shallow bays may be primarily associated with their morphometry. These bays may be important feeding grounds for young fishes and a slowing of their eutrophication may be neither feasible nor desirable.

Table 3. COMPARISON OF AREAS UNDER STRESS WITH OLIGOTROPHIC AREAS ON BASIS OF RELATIVE DENSITIES OF *DIAPTOMUS SICILIS* + *MINUTUS* AND *BOSMINA LONGIROSTRIS* (no./m^3).

	Density of Organisms at Maximum	
	Diaptomus sicilis + *minutus*	*Bosmina longirostris*
Areas under stress:		
Metropolitan Toronto	100	200,000
Oswego Area	150	300,000
Mexico Bay	500	50,000
Popham's and Weller's Bays	500	50,000
	312.5	150,000
MEAN *Bosmina*:*Diaptomus* ratio	480:1	
Oligotrophic Areas		
Station 17 (mid-western)	11	0
Station 77 (mid-eastern)	740	0
Station 83 (mid-eastern)	14	3,000
	255	1,000
MEAN *Bosmina*:*Diaptomus* ratio	3.9:1	

SECTION V

EFFECTS OF URBAN CENTERS ON ZOOPLANKTON POPULATIONS

INTRODUCTION

The zooplankton faunas of the Laurentian Great Lakes reflect water quality, with seasonal population equilibria apparently achieved in a short time between the quantity and quality of algal foods and the density of grazers. Thus, to some degree, the variety and abundance of the zooplankton is a reflection of the secondary influences of nutrient loading. In a similar fashion the population size structure, and ultimately the species composition of the zooplankton, is influenced by their fish predators (Wells, 1970).

As a working hypothesis, we suggest that urban development along the shores of Lake Ontario influences the community structure of inshore zooplankton populations during a growing season. A proposed mechanism might involve the input of nutrients, in turn stimulating the production of bluegreen algae, or the discharge of substances inhibitory or lethal to zooplankton growth. However, we will not attempt to further define this mechanism now. The purpose of this particular analysis of data was to test this hypothesis. Basically three questions are important. First, do differences in community structure occur lakewide on a defined horizontal scale within a growing season? If so, are such differences in community structure related to long-term changes demonstrated for Lake Ontario? And most importantly, what do such differences infer regarding the eutrophication of Lake Ontario's ecosystem?

Definition of the time-scale of changes during community succession is important to understanding eutrophication. This succession has been partially answered. Over time, the zooplankton of the Great Lakes probably have adapted to both changing foods and predators. During a recent period of accelerated cultural eutrophication commencing about 1900 (Beeton, 1969), major changes in zooplankton community structure probably were initiated. Diaptomus sicilis, the dominant form in Lake Superior, seems the most oligotrophic form in the Great Lakes (Patalas, 1972). Toward the eutrophic end of the spectrum, the summer zooplankton community of Lake Ontario has shifted since 1939 from dominance by Diaptomus to an abundance of Bosmina longirostris (McNaught and Buzzard, 1973). Thus long-term shifts have been documented for Lake Ontario and probably have occurred in all of the lower Great Lakes.

Lake Ontario is the seventeenth largest body of freshwater in the world (Hutchinson, 1957), an international resource of tremendous value to both the United States and Canada. Lake Erie, upstream to Lake Ontario, is certainly responsible for important organic and inorganic inputs. Thus it is also the purpose of this analysis of the Ontario ecosystem to detect the ecological impact of *in basin* inputs of nutrients and other substances. This will be attempted by dividing Lake Ontario into three segments, with special attention given to proximity to human influence. These designated areas thus include (1) inshore waters adjacent to urban centers and less than 30 m in depth, (2) inshore waters not offshore from but adjacent to rural areas, and (3) offshore waters greater than 30 m in depth.

Vertical plankton hauls were taken from the NOAA R/V Researcher at the 60 IFYGL sampling stations (Figure 12) on the cruises of 12 - 16 June, 10 - 14 July and 21 - 25 August 1972. Fortunately these 60 stations selected by the IFYGL management were comparable within the framework of our lakewide division. The urban inshore stations had a mean depth of 14.0 m, whereas those stations designated rural inshore had a mean depth of 18.5 m.

COMPARISON OF ZOOPLANKTON COMMUNITIES

Basically three types of comparisons will be made between populations inhabiting urban inshore, rural inshore, and offshore waters. First the relative densities of each species will be contrasted. Secondly, traditional measures of Shannon-Weaver diversity, richness and evenness will be utilized. Lastly, community indices, including the theoretical community competition coefficient (α) and community carrying-capacity (K) (Levins, 1968) will be used. Discussion and application to Great Lakes problems of these indices by Vandermeer (1972), Lane and McNaught (1970), and McNaught and Buzzard (1973) may be consulted for information on formulations and application.

Density Differences

In comparing densities (Table 4), relatively higher numbers, but fewer species of many cladocerans were found in urban inshore waters. *Daphnia longiremis* was limited to offshore waters, while *Bosmina longirostris*, *Ceriodaphnia*, *Chydorus*, *Polyphemus* and *Diaphanosoma* were usually more abundant offshore. However, on a unit volume basis (no./m^3) the cladocerans, usually considered warm water organisms, were more abundant inshore than offshore during June-August (mean of 64,325/m^3 versus 33,737/m^3). Roth and Stewart (1973) found a similar situation in Lake Michigan. In contrast to the cladocerans, the cyclopoid copepods did not exhibit such an obvious trend. Among the calanoid copepods, both *Diaptomus minutus* and *D. oregonensis* were more abundant offshore, as was *Limnocalanus*, a cold water form. A two-way analysis of variance demonstrated that zooplankton densities varied significantly ($p < .01$) with time (Table 7), but not with location. Clearly there are seasonal pulses in zooplankton densities, as we have long realized, but the differences between urban inshore, rural inshore and offshore waters are not effectively described in terms of total crustacean zooplankton densities.

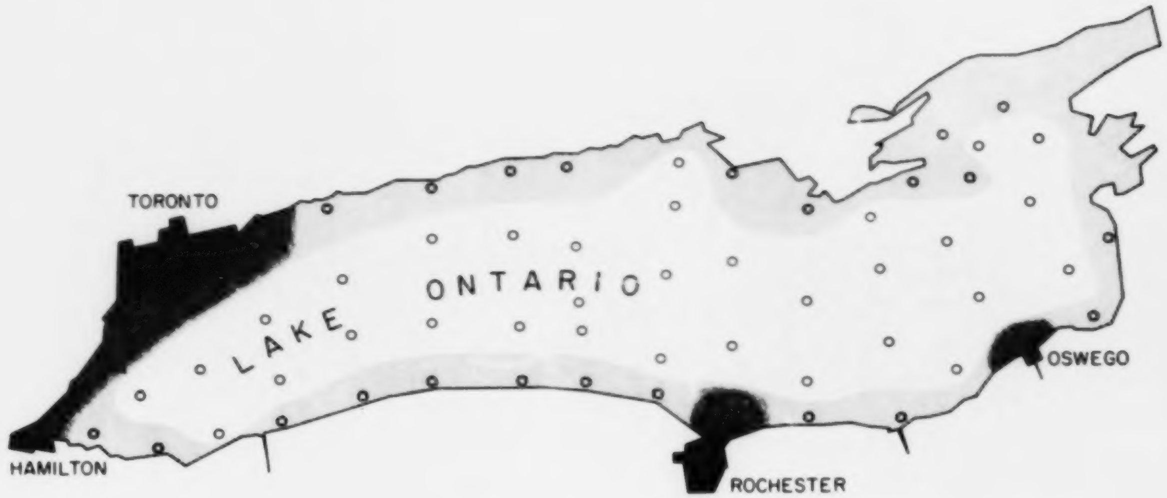

Figure 12. Lake Ontario, divided into three areas of differing trophy and community structure --- including offshore (unstippled), rural inshore (lightly stippled), and urban inshore waters (heavily stippled) --- as well as associated cities of Toronto, Hamilton, Rochester and Oswego, plus IFYGL sampling stations (O)

Table 4. COMPARATIVE MEAN DENSITIES ($\#/m^3$) OF CRUSTACEAN ZOOPLANKTON FROM 0 - 5 m DEPTH, CONTRASTING URBAN INSHORE VERSUS OFFSHORE COMMUNITY COMPOSITION.

	June 1972		July 1972		August 1972	
Species	Big Cities	Offshore	Big Cities	Offshore	Big Cities	Offshore
Cladocerans						
Leptodora kindtii	+	+	+	+	+	+
Bosmina coregoni	12	31	82	389	402	1,453
Bosmina longirostris	179	288	7,060	13,206	174,580	63,691
Daphnia galeata	-	22	108	3,027	1,873	99
Daphnia retrocurva	5	16	164	149	6,028	11,965
Daphnia longiremis	-	-	-	294	-	-
Ceriodaphnia lacustris	-	7	-	103	2,399	4,203
Chydorus sphaericus	-	16	-	640	30	100
Holopedium gibberum	-	-	-	54	43	7
Polyphemus pediculus	-	0	-	+	11	7
Diaphanosoma	-	-	-	-	-	3
Cyclopoida						
Copepodites	1,160	323	816	2,201	27,586	29,143
Cyclops bicuspidatus	650	1,424	17,555	12,478	4,158	12,113
Cyclops vernalis	76	28	43	190	1,011	643
Tropocyclops prasinus	25	11	11	66	1,874	1,676
Mesocyclops spp.	-	+	-	+	+	+
Calanoida						
Copepodites	35	60	97	124	203	116
Diaptomus minutus	67	225	23	91	39	74
Diaptomus oregonensis	10	71	-	76	94	108
Diaptomus sicilis	18	184	17	119	58	17
Limnocalanus macrurus	68	183	47	139	24	6
Eurytemora affinis	28	+	-	11	60	117

Diversity Differences

Comparison of the three lake regions, using Shannon-Weaver diversity, as well as the richness and evenness components, illustrated some significant differences between watermasses (Tables 5 - 6). In all three summer months, the urban inshore areas exhibited the lowest diversity (1.13 - 1.66 bits), with rural inshore areas intermediate (2.43 - 2.93) and offshore waters most diverse (2.94 - 3.31). Note that these ranges in diversity do not overlap. During the months June and July fewer species (12 - 14) were found in urban inshore areas, and the richness component was lower (2.49 - 3.85) than in offshore waters (3.76 - 4.32). In August the evenness component accounted for reduced diversity in urban inshore waters. The location and time effects on diversity were both highly significant ($p < .01$), as shown in Table 7.

Differences in Community Indices

Biotic communities should evolve toward a moderately low level of interspecific competition, otherwise species extinction will force such evolution. In apparently stable planktonic communities, as in oligotrophic lakes, the mean community competition coefficient might be on the order of 0.3. For a larger number of samples collected from Lake Michigan the mean community alpha was 0.31 (Lane and McNaught, 1970). Thus a third comparison, between location and alpha, was attempted (Table 7). During the months of June, July and August, 1972, the mean community alpha was highest for the communities of urban inshore waters. In two of three cases, alpha was lowest for communities of offshore waters. These indices suggest that offshore communities, with reduced levels of potential interspecific competition, are the most stable ecologically. In contrast, the urban inshore communities were again judged least stable, and by using an index independent of the previous Shannon-Weaver diversity computation. The effect of location upon alpha was highly significant ($p < .01$), while there was also a significant effect ($p < .05$) of time of year (Table 7). Thus two ecological indices have suggested greater instability in urban inshore regions.

Similarly, a second community index, carrying capacity (K), was higher for urban inshore waters, as compared to rural inshore areas (Tables 5 - 6). Since this theoretical estimate of carrying capacity is calculated using alpha (Levins, 1968), this conclusion is not unexpected. However, the ratio (N/K) of observed density (N) to theoretical carrying capacity (K) is probably a better index of eutrophication. During these same three months the N/K ratio suggested that urban areas were closer to carrying capacity than rural inshore waters. Moreover, since we are dealing with r-selection organisms, which fill only a small fraction of their carrying capacity, it was logical that these ratios would remain below 15%. It should also be noted that the offshore communities of zooplankton are closest to theoretical capacity (11 - 12%). A two-way ANOVA suggested that the effect of location on the ratio of N/K

Table 51. BIG CITIES (INSHORE) COMMUNITY STRUCTURE. Abbreviations in text.

Date	Density	Community Competition Coefficient		Relationships with Theor. Carrying-Capacity			Number Species		Diversity		
	N/m3	α	var α	K	N/K	K/ (β/β)	S	est. S	H	Rich	Even
1972											
15-19 May											
12-16 June	2,400	.53	.12	31,207	.08	.75	14	4	1.13	3.85	.98
10-14 July	26,020	.40	.12	192,088	.14	.61	12	5	1.41	2.49	1.31
21-25 August	220,486	.56	.11	3,580,032	.06	.81	20	5	1.66	3.56	1.28
20 Oct.-3 Nov.	19,547	.58	.11	319,395	.06	.90	21	5	1.57	4.66	1.79
27 Nov.-3 Dec.	9,476	.70	.11	118,479	.08	.95	18	5	1.73	4.27	1.38
1973											
5-9 Feb.	2,462	.68	.12	33,551	.07	.88	14	5	1.33	3.83	1.16
19-22 Mar.	1,325	.61	.11	10,571	.13	.86	10	4	1.28	2.88	1.28
24-28 April	1,608	.61	.11	11,451	.14	.81	9	4	.94	2.49	.92
12-16 June	7,474	.38	.10	52,521	.14	.71	11	5	1.25	2.58	1.2
MEAN (June 72-June 73)	32,310	.56		483,255	.07	.81	14.3		1.37	3.40	1.26

Table 5b. INSHORE (LESS BIG CITIES) COMMUNITY STRUCTURE.

Date	Density N/m3	Community Competition Coefficient α	var α	Theor. Carrying-Capacity K	N/K	K/ (β/β)	Species S	est. S	Diversity H	Rich	Even
1972											
15-19 May	495	.461	.12	5,239	.09	-	14	5	1.47	4.83	1.28
12-16 June	2,288	.33	.12	40,863	.06		19	7	2.43	5.36	1.90
10-14 July	20,299	.31	.09	213,957	.09		18	8	2.73	3.95	2.18
21-25 August	251,259	.39	.10	1,303,347	.19	.74	21	9	2.92	3.70	2.21
30 Oct.-3 Nov.	40,061	.54	.13	583,453	.12	.48	20	15	2.40	4.13	1.85
27 Nov.-3 Dec.	13,833	.46	.15	179,968	.08	1.00	21	9	2.94	4.83	2.23
1973											
5-9 Feb.	2,602	.60	.12	35,364	.07	.94	15	15	2.33	4.09	0.86
19-22 Mar.	1,830	.52	.13	28,179	.07	.88	18	8	2.17	5.83	1.73
24-28 April	4,124	.36	.13	44,203	.09	.46	19	12	2.43	4.97	1.9
12-16 June	26,132	.35	.10	405,847	.06	.73	19	8	2.575	4.08	2.0
MEAN (June 72-June 73)	40,270	.43		315,042	.13				2.55	4.55	1.87

Table 6. OFFSHORE COMMUNITY STRUCTURE.

Date	Density	Community Competition Coefficient		Relationships with Theor. Carrying-Capacity			Number Species		Diversity		
	N/m^3	α	var α	K	N/K	$K/(\beta/\beta)$	S	est. S	H	Rich	Even
1972											
15-19 May	670	.48	.13	5,613	.12	1.21	12	4	1.95	3.89	1.81
12-16 June	2,991	.29	.08	24,784	.12	.69	16	9	2.99	4.89	2.48
10-14 July	33,217	.27	.10	383,233	.09	.80	18	10	2.95	3.76	2.35
21-25 August	129,994	.41	.10	1,196,729	.11	.95	19	9	3.31	3.52	2.59
30 Oct.-3 Nov.	22,365	.49	.15	328,726	.07	.95	21	16	3.23	5.60	2.45
27 Nov.-3 Dec.	9,816	.54	.18	134,737	.07	1.07	19	16	3.30	4.51	2.58
1973											
5-9 Feb.	2,763	.47	.13	40,969	.07	.64	17		2.55	4.04	1.23
19-22 Mar.	2,291	.58	.11	20,424	.11	.94	12	15	2.76	3.27	2.55
24-28 April	1,891	.39	.18	18,540	.10	.89	15	18	2.96	4.27	1.0
12-16 June	12,158	.28	.11	186,072	.07	.91	19	7	2.69	4.41	2.10
MEAN (June 72-June 73)	24,165	.41		259,357	.09	1.01			3.19	4.25	2.15

Table 7. ANALYSIS OF VARIANCE (2-WAY ANOVA) FOR EFFECT OF LOCATION AND TIME UPON DENSITY, COMMUNITY COMPETITION COEFFICIENT, THE RATIO DENSITY TO CARRYING CAPACITY (N/K), NUMBER OF SPECIES (S), AND DIVERSITY (H). -- = p < .01, - = p<.05.

A. Effect upon density:

	Sum of Sq.	d.f.	Mean Sq.	
Total	10.6×10^{10}	26		
Location	11.7×10^{8}	2	5.8×10^{8}	NS
Time	9.8×10^{10}	8	12.3×10^{9}	--
Residual	7.3×10	16	4.5×10^{8}	

B. Effect upon competition coefficient:

Total	.411	26	.005	--
Location	.118	2	.003	--
Time	.249	8	.0003	
Residual	.004	16		

C. Effect upon N/K:

Total	.002	26		
Location	.00005	2	.00002	NS
Time	.0006	8	.00008	NS
Residual	.002	16	.0001	

D. Effect upon number species:

Total	335.4	26		
Location	96.5	2	48.2	--
Time	158.7	8	19.8	--
Residual	80.1	16	5.0	

E. Effect upon diversity:

Total	14.1	26		
Location	12.4	2	6.22	--
Time	1.2	8	.158	--
Residual	.41	16	2.59	

was not significant ($p > .05$) (Table 7). Thus the ratio of observed to theoretical carrying capacity (N/K) does not confirm the other evidence suggesting that dramatic changes are occurring within watermasses off larger cities along Lake Ontario's shores.

SIGNIFICANCE

Fewer species of crustacean zooplankters were found in urban inshore areas of Lake Ontario than in adjacent inshore or offshore regions. While the cladocerans *Daphnia*, *Ceriodaphnia* and *Chydorus* are important in rural inshore areas, they have given way to *Bosmina longirostris* and *Cyclops* in urban inshore waters.

Ecologically it was significant that seasonal and geographical differences in zooplankton distribution wherein the urban inshore waters were presumed more eutrophic than offshore waters, paralleled changes that have occurred in the zooplankton communities of the Great Lakes over much longer periods of time. These findings thus suggest that in waters offshore of urban centers we find drifting, planktonic communities which are highly modified, even though drifting along shore rapidly at velocities of 10 km/day (Scott, 1973). The causal effects of changes in zooplankton community composition off large cities quite plausibly are included in the concepts of algal resource availability, zooplankton selective feeding, and zooplankton predator abundance. These mechanisms are currently being investigated in our laboratory.

From a management viewpoint, the indices of diversity and theoretical community competition may be used to identify similar urban-influenced watermasses. More importantly, such indices should be useful in the conduct of surveys, especially as nutrient inputs to the Great Lakes are reduced.

SECTION VI

ACOUSTICAL ESTIMATES OF ZOOPLANKTON BIOMASS

THE ACOUSTICAL METHOD FOR DETERMINATION OF ZOOPLANKTON BIOMASS

The echo-integrating sonar, especially designed to be sensitive to particles of the size and density of zooplankton, has been described previously (McNaught, 1973). The approach was to transmit an exact waveshape (sound-wave) and detect the return, using a 100 channel signal averager. Each channel thus corresponded to 1% of depth (or time). The returning signal was simultaneously fed into an synchronous demodulator, then to a storage oscilloscope, providing a picture of zooplankton abundance with depth over time. The data from the signal averages, the heart of the system, were also displayed on an X-Y plotter, and later processed from paper tape using a program described below.

The 5-frequency sonar (53 or 80 kHz, 120, 200 and 500 kHz) operates on the principal that the maximum reflectivity from small targets (zooplankton) nearly the same density as water itself is obtained when the wavelength of sound is equivalent to the diameter of the (sphaerical) target (McNaught, 1968, 1969). Thus, as successively higher frequencies are employed, smaller and smaller organisms can be detected. For example, sound at a frequency of 200 kHz is maximally reflected by particles 2 mm in diameter, with reasonable sensitivity to particles down to 1 mm in diameter. Sound at a frequency of 500 kHz is maximally reflected by particles 0.8 mm in diameter, and to some extent by particles as small as 0.4 mm (Figure 13). Thus these two frequencies combined can be employed to give an estimate of the biomass of zooplankton between 0.8 and 2 mm in diameter. In the same way, signals from the 200 kHz and 120 kHz projectors provide an estimate of the biomass of zooplankton between 2 mm and 3 mm in diameter, and the 120 kHz and 80 kHz projectors provide an estimate of the biomass between 3 mm and 5 mm, which is chiefly fish larvae and fishes. These low frequency projectors are thus used to eliminate echoes from fishes from the zooplankton biomass estimate (or alternatively, to estimate the biomass of fishes in Lake Ontario).

Corrections for properties of Sound and Transducers

In determining the zooplankton biomass with depth using acoustical techniques, only physical correction factors have been employed. The necessary factors are (a) the relative strength of the acoustical output (frequency normalization) for each frequency transducer, (b) the relative attenuation of sound at 80, 120, 200 and 500 kHz, and (c) the beam angle of the transducer (Table 8). These correction factors have been employed in writing a program to correct raw field data.

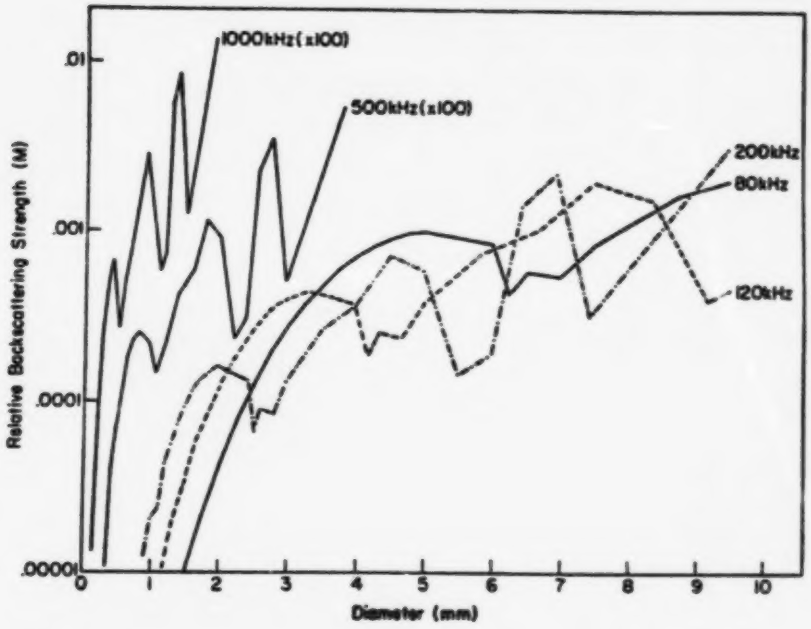

Figure 13. Relationship between backscattering strength (Appendix B), used to calculate biomass of zooplankton, and size of spherical particles for five frequencies (80, 120, 200, 500 and 1000 kHz). (From McNaught, 1969)

Table 8. CORRECTION FACTORS FOR ACOUSTICAL RETURNS NECESSARY TO EQUATE RETURNS TO BIOMASS OF ZOOPLANKTON

Formula: $\frac{\text{intensity x normalization x attenuation}}{\text{beam correction}}$ = Correction Factor

	(Step 1) Frequency Normalization	(Step 2) Attenuation factor (x)			(Step 3)	
Corrections	Bottom Corr. factor (x)	Channel	Equiv. Depth	(M)	Beam Correction factor (5° angle) (÷)	
80 kHz	1.056	4	1.4	1.08	1 m	1.00
		5	1.7	1.12	2 m	1.16
					3 m	1.33
120 kHz	1.161	6	2.0	1.17	4 m	1.51
		7	2.4	1.24	5 m	1.71
		8	2.7	1.29	6 m	1.92
					7 m	2.13
200 kHz	1.735	9	3.1	1.37	8 m	2.37
		10	3.4	1.42	9 m	2.61
		11	3.7	1.48	10 m	2.86
500 kHz	3.282	12	4.1	1.55		

Data Correction

In Table 9a we see an example of raw field data (first four sets at 80, 120, 200 and 500 kHz). These acoustical reflectivities have been multiplied by the suggested correction factors (Table 8) to yield four sets of "corrected profiles" (Table 9b). Then these corrected profiles are subtracted (120 - 80 kHz, 200 - 120 kHz and 500 - 200 kHz) to yield biomass estimates for particles of the three size ranges previously indicated (Table 9c). Since the data are not useful in 1% increments of the gated interval or scan depth, they are then converted to acoustical reflectivity per 5 m interval, again for three size ranges (last block) (Table 9d).

Calibration of Acoustical Technique

An empirically based calibration was made by comparing the sum of differences in acoustical reflectivity, specifically between the 200 kHz and 120 kHz channels and the 500 kHz and 200 kHz channels, with the product of numerical density of zooplankton and their mean weight. This calibration utilized the data of the cruises of 21 - 25 August 1972 when animals were abundant and 30 October - 3 November 1972 when animals were relatively scarce. Because the 64μ aperture net used to collect animals was most efficient over a 5 m tow, and because the sonar likewise was most sensitive from 0 - 5 m, all calibration points were based upon 0 - 5 m data. A linear regression was obtained for the relationship between acoustical reflectivity (D.C. volts) and zooplankton biomass (g/m^3 dry-wt), such that biomass (g/m^3) is related to corrected acoustical reflectivity (D.C. volts) as follows:

$$\text{Biomass } (g/m^3) = 0.681 + 13.53 \begin{pmatrix}\text{Corrected}\\ \text{Acoust. Ref}\end{pmatrix}$$

Thus we observe (Figure 14) that the acoustical technique is insensitive to biomass levels of less than 0.68 g dry-wt/m^3. At very low acoustical reflectivity, it appears that biomass is overestimated.

Table 9 (a). **EXAMPLE OF UNCORRECTED ACOUSTICAL REFLECTIVITY AT FOUR FREQUENCIES (80, 120, 200 AND 500 kHz) OVER 100 CHANNELS OR 1% DEPTH INCREMENTS**

```
80 KC
01  .2428 02  .1931 03  .1957 04  .1943 05  .1944 06  .1914 07  .1934
08  .1797 09  .1879 10  .1898 11  .1952 12  .1953 13  .1898 14  .1869
15  .1856 16  .1869 17  .1852 18  .1912 19  .1911 20  .1882 21  .1863
22  .1970 23  .1869 24  .1895 25  .1894 26  .1888 27  .1922 28  .1974
29  .1918 30  .1888 31  .1871 32  .1822 33  .1927 34  .1898 35  .1897
36  .1857 37  .1867 38  .1886 39  .1866 40  .1867 41  .1890 42  .1906
43  .1856 44  .1882 45  .1885 46  .1863 47  .1964 48  .1924 49  .1890
50  .1974 51  .1927 52  .1854 53  .1921 54  .1891 55  .1906 56  .1845
57  .1867 58  .1870 59  .1902 60  .1896 61  .1893 62  .1923 63  .1986
64  .1867 65  .1917 66  .1874 67  .1909 68  .1861 69  .1896 70  .1918
71  .1871 72  .1928 73  .1919 74  .1824 75  .1854 76  .1894 77  .1859
78  .1879 79  .1883 80  .1935 81  .1964 82  .1848 83  .1836 84  .1866
85  .1876 86  .1898 87  .1860 88  .1924 89  .1938 90  .4963 91  .3940
92  .3581 93 1.1704 94  .4711 95  .2054 96  .1733 97  .1820 98  .1892
99  .1896 **  .1118
120 KC
01 1.2135 02  .3059 03  .1918 04  .1757 05  .1744 06  .1722 07  .1716
08  .1740 09  .1750 10  .1704 11  .1720 12  .1710 13  .1655 14  .1676
15  .1690 16  .1656 17  .1653 18  .1634 19  .1644 20  .1655 21  .1680
22  .1673 23  .1668 24  .1676 25  .1651 26  .1686 27  .1663 28  .1677
29  .1669 30  .1664 31  .1651 32  .1658 33  .1673 34  .1653 35  .1688
36  .1688 37  .1695 38  .1658 39  .1639 40  .1639 41  .1630 42  .1853
43  .1699 44  .1656 45  .1651 46  .1684 47  .1656 48  .1671 49  .1651
50  .1659 51  .1672 52  .1690 53  .1636 54  .1654 55  .1697 56  .1673
57  .1653 58  .1660 59  .1637 60  .1661 61  .1675 62  .1684 63  .1667
64  .1614 65  .1639 66  .1655 67  .1656 68  .1706 69  .1678 70  .1673
71  .1712 72  .1659 73  .1628 74  .1658 75  .1680 76  .1641 77  .1671
78  .1687 79  .1664 80  .1667 81  .1656 82  .1660 83  .1666 84  .1660
85  .1679 86  .1643 87  .1658 88  .1654 89  .1666 90  .5752 91 1.7955
92 1.1083 93  .3154 94  .1754 95  .1714 96  .1730 97  .1759 98  .1748
99  .1769 **  .1135
200 KC
01  .8153 02  .3323 03  .2640 04  .2547 05  .2465 06  .2360 07  .2287
08  .2222 09  .2175 10  .2167 11  .2128 12  .2117 13  .2104 14  .2098
15  .2158 16  .2255 17  .2320 18  .2362 19  .2390 20  .2407 21  .2417
22  .2423 23  .2441 24  .2436 25  .2423 26  .2429 27  .2440 28  .2437
29  .2418 30  .2418 31  .2416 32  .2413 33  .2428 34  .2417 35  .2403
36  .2418 37  .2428 38  .2401 39  .2393 40  .2424 41  .2430 42  .2440
43  .2418 44  .2409 45  .2417 46  .2394 47  .2399 48  .2423 49  .2427
50  .2425 51  .2419 52  .2409 53  .2394 54  .2418 55  .2405 56  .2416
57  .2410 58  .2412 59  .2391 60  .2397 61  .2410 62  .2423 63  .2418
64  .2424 65  .2404 66  .2403 67  .2396 68  .2405 69  .2424 70  .2418
71  .2408 72  .2426 73  .2416 74  .2413 75  .2406 76  .2404 77  .2408
78  .2405 79  .2417 80  .2417 81  .2415 82  .2405 83  .2403 84  .2400
85  .2400 86  .2403 87  .2403 88  .2401 89  .2411 90  .2556 91  .2393
92  .2524 93  .2529 94  .2503 95  .2486 96  .2488 97  .2464 98  .2455
99  .2435 **  .1145
500 KC
01  .2486 02  .2141 03  .2078 04  .2047 05  .2036 06  .2021 07  .2016
08  .2012 09  .1998 10  .1994 11  .1994 12  .1987 13  .1986 14  .1982
15  .1931 16  .1978 17  .1971 18  .1969 19  .1978 20  .1971 21  .1966
22  .1968 23  .1970 24  .1970 25  .1966 26  .1954 27  .1955 28  .1963
29  .1957 30  .1961 31  .1960 32  .1958 33  .1958 34  .1954 35  .1949
36  .1959 37  .1958 38  .1953 39  .1954 40  .1951 41  .1952 42  .1943
43  .1941 44  .1952 45  .1953 46  .1944 47  .1950 48  .1950 49  .1950
50  .1951 51  .1947 52  .1946 53  .1949 54  .1945 55  .1944 56  .1943
57  .1945 58  .1945 59  .1935 60  .1938 61  .1951 62  .1951 63  .1944
64  .1943 65  .1946 66  .1938 67  .1943 68  .1941 69  .1946 70  .1948
71  .1944 72  .1938 73  .1939 74  .1942 75  .1946 76  .1939 77  .1940
78  .1948 79  .1944 80  .1943 81  .1942 82  .1941 83  .1942 84  .1942
85  .1941 86  .1937 87  .1941 88  .1937 89  .1940 90  .1941 91  .1947
92  .1946 93  .1940 94  .1939 95  .1941 96  .1936 97  .1938 98  .1937
99  .1933 **  .1155
```

Table 9 (b). CORRECTED ACOUSTICAL PROFILES

```
CORRECTED PROFILES FOR
AUG STA 17 FA 10**4 AVG 5 DEPTH 130 SCAN 170
80 KC
01   .2210 02  .1758 03  .1761 04  .1769 05  .1770 06  .1742 07  .1761
08   .1636 09  .1710 10  .1728 11  .1777 12  .1776 13  .1728 14  .1720
15   .1690 16  .1701 17  .1686 18  .1741 19  .1740 20  .1713 21  .1714
22   .1793 23  .1720 24  .1725 25  .1724 26  .1719 27  .1750 28  .1797
29   .1746 30  .1719 31  .1703 32  .1659 33  .1754 34  .1728 35  .1727
36   .1690 37  .1700 38  .1717 39  .1700 40  .1700 41  .1720 42  .1735
43   .1690 44  .1713 45  .1716 46  .1696 47  .1788 48  .1751 49  .1720
50   .1797 51  .1754 52  .1688 53  .1749 54  .1721 55  .1735 56  .1680
57   .1700 58  .1702 59  .1731 60  .1726 61  .1723 62  .1751 63  .1810
64   .1700 65  .1745 66  .1706 67  .1736 68  .1694 69  .1726 70  .1746
71   .1703 72  .1755 73  .1747 74  .1660 75  .1688 76  .1724 77  .1692
78   .1710 79  .1714 80  .1761 81  .1788 82  .1682 83  .1671 84  .1700
85   .1708 86  .1728 87  .1693 88  .1751 89  .1764 90  .4518 91  .3587
92   .3260 93 1.0654 94  .4288 95  .1870 96  .1578 97  .1657 98  .1722
99   .1726 **  .1018
120 KC
01 1.2145 02  .3062 03  .1920 04  .1758 05  .1745 06  .1723 07  .1717
08   .1741 09  .1751 10  .1705 11  .1721 12  .1711 13  .1656 14  .1677
15   .1691 16  .1657 17  .1654 18  .1635 19  .1645 20  .1656 21  .1681
22   .1674 23  .1669 24  .1677 25  .1652 26  .1667 27  .1664 28  .1678
29   .1670 30  .1665 31  .1652 32  .1659 33  .1674 34  .1654 35  .1689
36   .1689 37  .1696 38  .1659 39  .1640 40  .1640 41  .1631 42  .1855
43   .1700 44  .1657 45  .1652 46  .1665 47  .1657 48  .1672 49  .1652
50   .1660 51  .1673 52  .1691 53  .1637 54  .1655 55  .1698 56  .1674
57   .1654 58  .1661 59  .1638 60  .1662 61  .1676 62  .1665 63  .1668
64   .1615 65  .1640 66  .1656 67  .1657 68  .1707 69  .1679 70  .1674
71   .1713 72  .1660 73  .1629 74  .1659 75  .1681 76  .1642 77  .1672
78   .1668 79  .1665 80  .1668 81  .1659 82  .1661 83  .1667 84  .1681
85   .1680 86  .1644 87  .1659 88  .1655 89  .1667 90  .5757 91 1.7970
92 1.1092 93  .3157 94  .1755 95  .1715 96  .1731 97  .1760 98  .1749
99   .1770 **  .1136
200 KC
01 1.2194 02  .4970 03  .3948 04  .3809 05  .3687 06  .3530 07  .3421
08   .3323 09  .3253 10  .3241 11  .3183 12  .3166 13  .3147 14  .3138
15   .3228 16  .3373 17  .3470 18  .3533 19  .3575 20  .3600 21  .3615
22   .3624 23  .3651 24  .3643 25  .3624 26  .3633 27  .3649 28  .3645
29   .3616 30  .3616 31  .3613 32  .3609 33  .3631 34  .3615 35  .3594
36   .3616 37  .3631 38  .3591 39  .3579 40  .3625 41  .3634 42  .3649
43   .3616 44  .3603 45  .3615 46  .3581 47  .3588 48  .3624 49  .3630
50   .3627 51  .3618 52  .3603 53  .3581 54  .3616 55  .3597 56  .3613
57   .3604 58  .3607 59  .3576 60  .3585 61  .3604 62  .3624 63  .3616
64   .3625 65  .3596 66  .3594 67  .3584 68  .3597 69  .3625 70  .3616
71   .3601 72  .3628 73  .3613 74  .3609 75  .3598 76  .3596 77  .3601
78   .3597 79  .3615 80  .3615 81  .3612 82  .3597 83  .3594 84  .3590
85   .3590 86  .3594 87  .3594 88  .3591 89  .3606 90  .3823 91  .3579
92   .3775 93  .3782 94  .3744 95  .3718 96  .3721 97  .3665 98  .3672
99   .3642 **  .1713
500 KC
01   .7033 02  .6057 03  .5879 04  .5791 05  .5760 06  .5718 07  .5764
08   .5692 09  .5653 10  .5641 11  .5641 12  .5622 13  .5619 14  .5607
15   .5605 16  .5596 17  .5576 18  .5571 19  .5596 20  .5576 21  .5562
22   .5568 23  .5574 24  .5574 25  .5568 26  .5528 27  .5540 28  .5554
29   .5537 30  .5548 31  .5545 32  .5540 33  .5540 34  .5528 35  .5514
36   .5542 37  .5540 38  .5525 39  .5528 40  .5520 41  .5523 42  .5511
43   .5491 44  .5523 45  .5525 46  .5500 47  .5517 48  .5517 49  .5517
50   .5520 51  .5503 52  .5506 53  .5514 54  .5503 55  .5500 56  .5497
57   .5503 58  .5503 59  .5475 60  .5483 61  .5520 62  .5520 63  .5494
64   .5497 65  .5506 66  .5483 67  .5497 68  .5491 69  .5506 70  .5511
71   .5500 72  .5483 73  .5486 74  .5494 75  .5506 76  .5486 77  .5469
78   .5511 79  .5500 80  .5497 81  .5494 82  .5491 83  .5494 84  .5494
85   .5491 86  .5480 87  .5491 88  .5480 89  .5489 90  .5491 91  .5508
92   .5506 93  .5489 94  .5486 95  .5491 96  .5477 97  .5483 98  .5480
99   .5469 **  .3268
```

Table 9 (c). DIFFERENCES BETWEEN REFLECTIVITIES AT ADJACENT FREQUENCY ENVELOPES (120-80 kHz, 200-120 kHz, AND 500-200 kHz)

```
PRINTOUT OF CHANNEL DIFFS?
>YES
120-80 KC
01  .9935 02  .1304 03  .0138 04 -.0010 05 -.0024 06 -.0019 07 -.0043
08  .0106 09  .0041 10 -.0022 11 -.0056 12 -.0066 13 -.0071 14 -.0042
15  .0002 16 -.0044 17 -.0032 18 -.0105 19 -.0094 20 -.0057 21 -.0033
22 -.0119 23 -.0050 24 -.0046 25 -.0072 26 -.0031 27 -.0065 28 -.0119
29 -.0076 30 -.0053 31 -.0051 32  .0001 33 -.0060 34 -.0073 35 -.0037
36 -.0001 37 -.0003 38 -.0057 39 -.0060 40 -.0059 41 -.0069 42  .0119
43  .0011 44 -.0056 45 -.0064 46 -.0011 47 -.0130 48 -.0079 49 -.0068
50 -.0137 51 -.0081 52  .0004 53 -.0111 54 -.0066 55 -.0037 56 -.0006
57 -.0045 58 -.0041 59 -.0093 60 -.0064 61 -.0047 62 -.0065 63 -.0141
64 -.0084 65 -.0105 66 -.0050 67 -.0080 68  .0013 69 -.0047 70 -.0072
71  .0010 72 -.0095 73 -.0118 74 -.0001 75 -.0006 76 -.0082 77 -.0020
78 -.0022 79 -.0049 80 -.0093 81 -.0128 82 -.0021 83 -.0004 84 -.0019
85 -.0027 86 -.0083 87 -.0034 88 -.0096 89 -.0097 90  .1239 91 1.4383
92  .7832 93 -.7498 94 -.2533 95 -.0154 96  .0154 97  .0104 98  .0027
99  .0045 **  .0118
200-120 KC
01  .0049 02  .1908 03  .2029 04  .2051 05  .1941 06  .1806 07  .1703
08  .1582 09  .1502 10  .1536 11  .1461 12  .1455 13  .1490 14  .1460
15  .1536 16  .1715 17  .1816 18  .1897 19  .1929 20  .1944 21  .1934
22  .1950 23  .1981 24  .1966 25  .1972 26  .1946 27  .1985 28  .1966
29  .1946 30  .1951 31  .1961 32  .1950 33  .1957 34  .1961 35  .1905
36  .1927 37  .1935 38  .1932 39  .1939 40  .1985 41  .2003 42  .1795
43  .1916 44  .1946 45  .1963 46  .1895 47  .1931 48  .1952 49  .1978
50  .1967 51  .1945 52  .1912 53  .1943 54  .1961 55  .1899 56  .1939
57  .1950 58  .1946 59  .1938 60  .1923 61  .1928 62  .1939 63  .1948
64  .2010 65  .1955 66  .1938 67  .1926 68  .1890 69  .1946 70  .1942
71  .1888 72  .1968 73  .1984 74  .1950 75  .1917 76  .1953 77  .1929
78  .1909 79  .1950 80  .1947 81  .1953 82  .1936 83  .1927 84  .1908
85  .1909 86  .1950 87  .1935 88  .1936 89  .1939 90 -.1934 91-1.4391
92 -.7317 93  .0626 94  .1988 95  .2003 96  .1990 97  .1925 98  .1922
99  .1871 **  .0577
500-200 KC
01 -.5161 02  .1087 03  .1931 04  .1982 05  .2074 06  .2188 07  .2283
08  .2369 09  .2400 10  .2400 11  .2459 12  .2455 13  .2472 14  .2470
15  .2377 16  .2224 17  .2106 18  .2038 19  .2022 20  .1976 21  .1947
22  .1944 23  .1923 24  .1930 25  .1944 26  .1895 27  .1890 28  .1909
29  .1920 30  .1932 31  .1932 32  .1931 33  .1908 34  .1913 35  .1920
36  .1926 37  .1908 38  .1934 39  .1949 40  .1894 41  .1886 42  .1862
43  .1875 44  .1920 45  .1910 46  .1919 47  .1929 48  .1893 49  .1867
50  .1893 51  .1891 52  .1903 53  .1934 54  .1886 55  .1903 56  .1884
57  .1898 58  .1895 59  .1898 60  .1898 61  .1915 62  .1896 63  .1878
64  .1872 65  .1910 66  .1889 67  .1914 68  .1894 69  .1880 70  .1895
71  .1898 72  .1855 73  .1872 74  .1885 75  .1907 76  .1890 77  .1887
78  .1914 79  .1885 80  .1882 81  .1882 82  .1894 83  .1900 84  .1905
85  .1902 86  .1886 87  .1897 88  .1889 89  .1883 90  .1669 91  .1929
92  .1731 93  .1706 94  .1742 95  .1773 96  .1756 97  .1798 98  .1808
99  .1827 **  .1555
```

Table 9 (d). **THREE PROFILES AT CONSTANT 5 m INTERVALS, IN D.C. VOLTS/m^3. LAKE ONATRIO, STATION 17, AUGUST 1972.**

```
 PUNCHOUT CHANNEL DIFFERENCES?
>NO
 AUG STA 17 PA 10**4 AVG 5 DEPTH 130 SCAN 170
 MEAN VALUE OF PROFILES OVER 5M INTERVALS


 CH    1- 2      120-80    .9935    200-120    .0049     500-200   -.2037    5M
 CH    3- 4      120-80   1.1239    200-120    .1957     500-200   -.0060   10M
 CH    5- 6      120-80   1.1377    200-120    .3936     500-200    .2051   15M
 CH    7- 8      120-80   1.1366    200-120    .6037     500-200    .4377   20M
 CH    9-10      120-80   1.1342    200-120    .7976     500-200    .6777   25M
 CH   11-12      120-80   1.1323    200-120    .9765     500-200    .9234   30M
 CH   13-14      120-80   1.1280    200-120   1.1463     500-200   1.1705   35M
 CH   15-16      120-80   1.1366    200-120   1.3070     500-200   1.4005   40M
 CH   17-18      120-80   1.1427    200-120   1.4571     500-200   1.6077   45M
 CH   19-20      120-80   1.1404    200-120   1.6107     500-200   1.8076   50M
 CH   21-22      120-80   1.1349    200-120   1.7566     500-200   2.0082   55M
 CH   23-24      120-80   1.1282    200-120   1.9023     500-200   2.1946   60M
 CH   25-26      120-80   1.1211    200-120   2.0514     500-200   2.3566   65M
 CH   27-28      120-80   1.1169    200-120   2.1974     500-200   2.5767   70M
 CH   29-30      120-80   1.1171    200-120   2.3510     500-200   2.7693   75M
 CH   31-32      120-80   1.1127    200-120   2.5225     500-200   2.9625   80M
 CH   33-34      120-80   1.1095    200-120   2.7041     500-200   3.1535   85M
 CH   35-36      120-80   1.0990    200-120   2.8938     500-200   3.3456   90M
 CH   37-38      120-80   1.0896    200-120   3.0866     500-200   3.5380   95M
 CH   39-40      120-80   1.0839    200-120   3.2811     500-200   3.7301  100M
 CH   41-42      120-80   1.0806    200-120   3.4745     500-200   3.9177  105M
 CH   43-44      120-80   1.0687    200-120   3.6694     500-200   4.1074  110M
 CH   45-46      120-80   1.0637    200-120   3.8676     500-200   4.2989  115M
 CH   47-48      120-80   1.0589    200-120   4.0642     500-200   4.4900  120M
 CH   49-50      120-80   1.0516    200-120   4.2613     500-200   4.6790  125M
 CH   51-52      120-80   1.0486    200-120   4.4559     500-200   4.8686  130M
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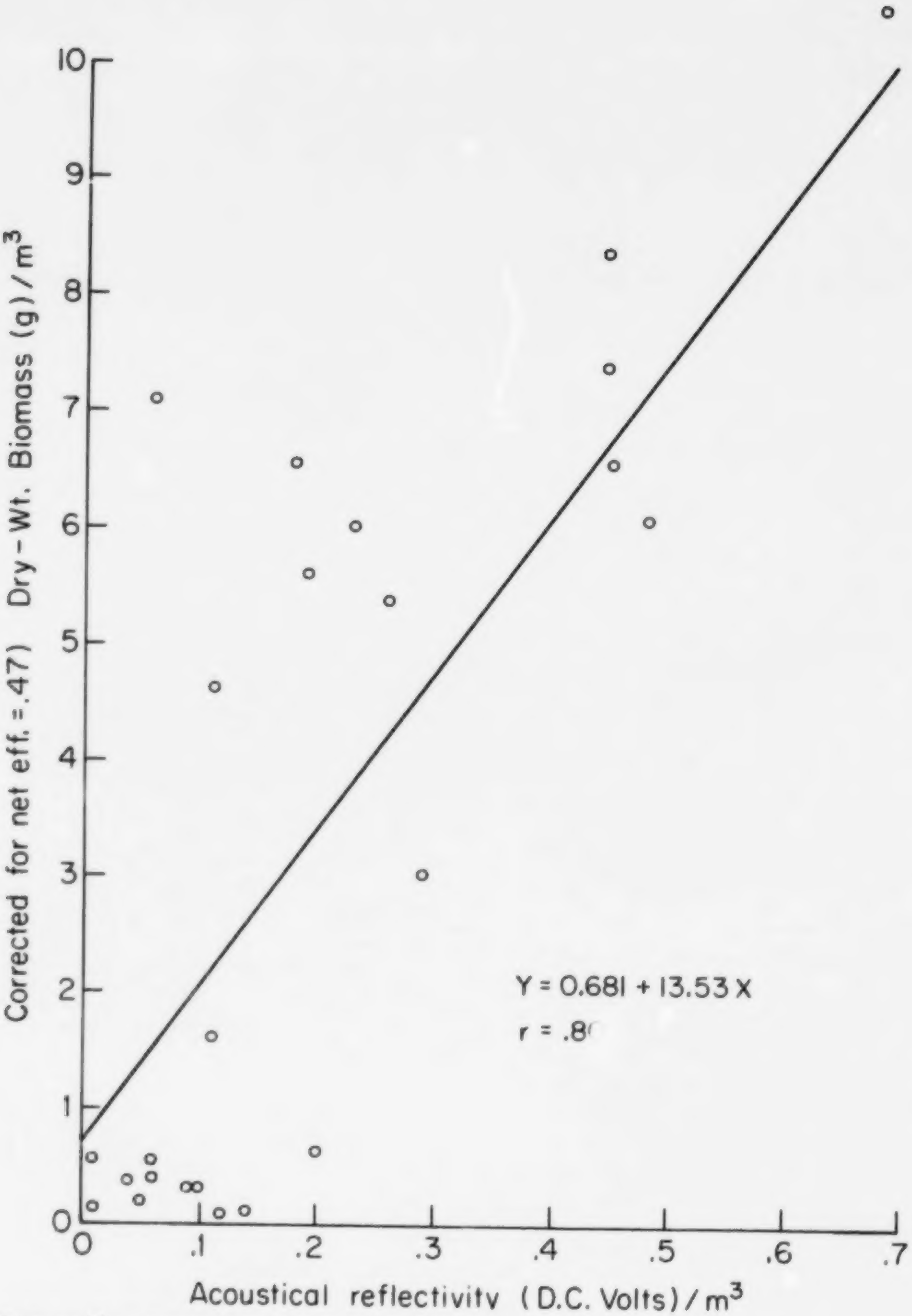

Figure 14. Regression of zooplankton biomass (g dry wt/m^3) against acoustical reflectivity (D.C. volts/m^3), made from actual samples and acoustical profiles collected simultaneously on Lake Ontario

VERTICAL PROFILES OF RELATIVE ZOOPLANKTON BIOMASS

Since the trophogenic zone, or the waters where phytoplankton photosynthesis exceeds respiration, is confined to the upper 30 m in Lake Ontario, previous studies of zooplankton abundance have centered upon the upper 50 m of water (Patalas, 1969; Watson, 1974). A major contribution of the zooplankton acoustical samples is an indication of abundant, zooplankton size particles at greater depths than 50 m.

Once acoustical data have been placed in 5 m depth intervals for each station (Table 9), it is relatively simple to produce a lakewide estimate (Table 10) for each cruise. On 30 October - 3 November 1972, 2 - 3 mm particles (200 - 120 kHz) and 0.8 - 2 mm particles (500 - 200 kHz) were both most abundant in the deepest waters at 230 m depth (Table 10). Summaries for the distribution of 0.8 - 3.0 mm particles, the size-range for most crustacean zooplankton, are presented in Table 11 and Figure 15. During 21 - 25 August 1972 particles were relatively most abundant between 100 and 200 m depth. From 30 October - 3 November 1972 zooplankton sized particles were most common in the deepest waters. Over the period 12 - 16 June 1973, these same particles were most abundant between 60 and 130 m depth. These average estimates of biomass, made using acoustical techniques, are for all 60 stations of the IFYGL grid and usually represent a mean derived from 5 days of measurements made both day and night.

Table 10. ACOUSTICAL RELFECTIVITY (D.C. VOLTS) FOR THREE FREQUENCY ENVELOPES (120-80 kHz, 200-120 kHz, AND 500-200 kHz), FOR 21-25 AUGUST 1972.
(average over 5 m intervals)

Meters	No. of Stations	120-80 kHz	200-120 kHz	500-200 kHz
5	58	.1516	.3755	.0989
10	58	.2222	.5884	.3814
15	54	.1686	.8815	.7182
20	49	.1500	1.2811	.9395
25	41	.4181	1.4240	1.1877
30	32	.3023	1.2665	1.7210
35	29	.3819	1.1621	1.9927
40	27	.1746	1.2860	2.4312
45	26	.3236	1.4446	2.6259
50	26	.4201	1.5642	2.9302
55	25	.5493	1.4088	3.2152
60	25	.6532	1.5200	3.5127
65	25	.7583	1.6323	3.8100
70	23	1.1152	1.7753	3.9904
75	22	1.3273	1.9245	4.2193
80	21	.8720	1.5114	2.8713
85	21	.9278	1.6023	3.0559
90	19	1.2515	1.7767	3.2211
95	19	1.3220	1.8696	3.4035
100	17	-.0490	1.9648	5.6283
105	16	.0424	1.9873	6.1378
110	16	.0213	2.0753	6.4365
115	15	.4714	2.3157	7.0064
120	14	.4346	3.6347	7.5339
125	13	.3407	3.7682	8.6384
130	12	.2243	3.9223	9.1292
135	11	.1361	4.0181	9.8857
140	10	.0770	4.2136	10.9437
145	10	.0639	4.3700	11.3369
150	9	-.1263	4.9523	12.4129
155	8	-.1264	6.2623	13.7948
160	8	-.1446	6.4664	14.2425
165	8	-.1634	6.6709	14.6905
170	7	-.0553	7.6473	16.7466
175	5	-.6382	8.8057	20.2833
180	4	-.8859	9.5345	25.5993
185	4	-.9191	9.8014	26.3118
190	2	-.2769	4.4468	5.0913
195	2	-.2877	4.5589	5.2358
200	2	-.2913	4.6666	5.3754
205	1	-.7470	1.2507	1.7701
210	1	-.7710	1.2814	1.8172
215	1	-.8052	1.3164	1.8631
220	1	-.8364	1.3534	1.9085
225	1	-.8714	1.3887	1.9555
230	1	-.9040	1.4197	2.0050

Table 11. MEAN ACOUSTICAL REFLECTIVITY (D.C. VOLTS/m^3) AND RELATIVE BIOMASS (%) FOR 5 m INTERVALS, LAKE ONTARIO, 1972-73.

Depth Interval (m)	August 1972		November 1972		February 1973	June 1973	
	Acoustical Reflectivity	Relative Biomass	Acoustical Reflectivity	Relative Biomass		Acoustical Reflectivity	Relative Biomass
0-5	.46	.001	0.	.0	0.	0.	0.
5-10	.96	.002	0.	.0	0.	0.	0.
10-15	1.59	.004	.11	.0004	0.	0.	0.
15-20	2.21	.005	.11	.0004	0.	.15	.001
20-25	2.60	.006	.08	.0003	0.	0.	0.
25-30	2.98	.007	0.	.0	0.	.13	.001
30-35	3.15	.007	.03	.0001	0.	.25	.002
35-40	3.71	.009	.11	.0004	0.	.71	.007
40-45	4.06	.009	.31	.001	0.	.94	.009
45-50	4.49	.010	.53	.002	0.	1.16	.011
50-55	4.61	.011	.88	.003	0.	1.39	.013
55-60	5.03	.012	1.09	.004	0.	1.58	.016
60-65	5.44	.013	1.32	.004	0.	1.82	.018
65-70	5.76	.013	2.29	.007	0.	2.08	.020
70-75	6.13	.014					
75-80	4.38	.010	2.58	.008	0.	2.42	.024
80-85	4.65	.011	2.83	.009	0.	3.61	.036
85-90	4.99	.012	3.07	.009	0.	4.38	.044
90-95	5.25	.012	3.32	.010	0.	4.48	.044
95-100	7.58	.012	3.81	.012	0.	4.83	.048
100-105	8.11	.019	4.18	.014	0.	5.19	.051
105-110	8.50	.020	4.43	.014	0.	5.56	.055
110-115	9.31	.022	5.22	.017	0.	5.93	.059
115-120	11.16	.026	5.26	.017	0.	6.30	.062
120-125	12.39	.029	5.95	.019	0.	6.71	.067
125-130	13.04	.030	6.23	.020	0.	7.12	.070
130-135	13.89	.032	6.51	.021	0.	3.26	.032
135-140	15.15	.035	6.79	.022	0.	3.53	.035

Table 11 (continued). MEAN ACOUSTICAL REFLECTIVITY (D.C. VOLTS/m^3) AND RELATIVE BIOMASS (%) FOR 5 m INTERVALS, LAKE ONTARIO, 1972-73.

Depth Interval (m)	August 1972		November 1972		February 1973	June 1973	
	Acoustical Reflectivity	Relative Biomass	Acoustical Reflectivity	Relative Biomass		Acoustical Reflectivity	Relative Biomass
140-145	15.70	.037	7.63	.025	0.	3.74	.037
145-150	17.36	.041	7.91	.026	0.	3.98	.040
150-155	20.05	.047	9.04	.029	0.	4.21	.042
155-160	20.07	.048	9.34	.030	0.	4.45	.044
160-165	21.36	.050	9.63	.031	0.	4.69	.047
165-170	24.38	.057	9.93	.032	0.	6.14	.061
170-175	29.08	.068	10.29	.033	0.		
175-180	35.12	.082	11.32	.037			
180-185	36.11	.084	12.62	.041			
185-190	9.53	.022	11.52	.037			
190-195	9.78	.023	11.51	.037			
195-200	9.97	.023	11.83	.038			
200-205	3.02	.007	18.51	.060			
205-210	3.09	.007	18.97	.062			
210-215	3.17	.007	19.43	.063			
215-220	3.25	.008	19.83	.064			
220-225	3.33	.008	20.36	.066			
225-230	3.41	.008	20.81	.068			
	428.03	1.01	307.34	0.994		100.56	1.01

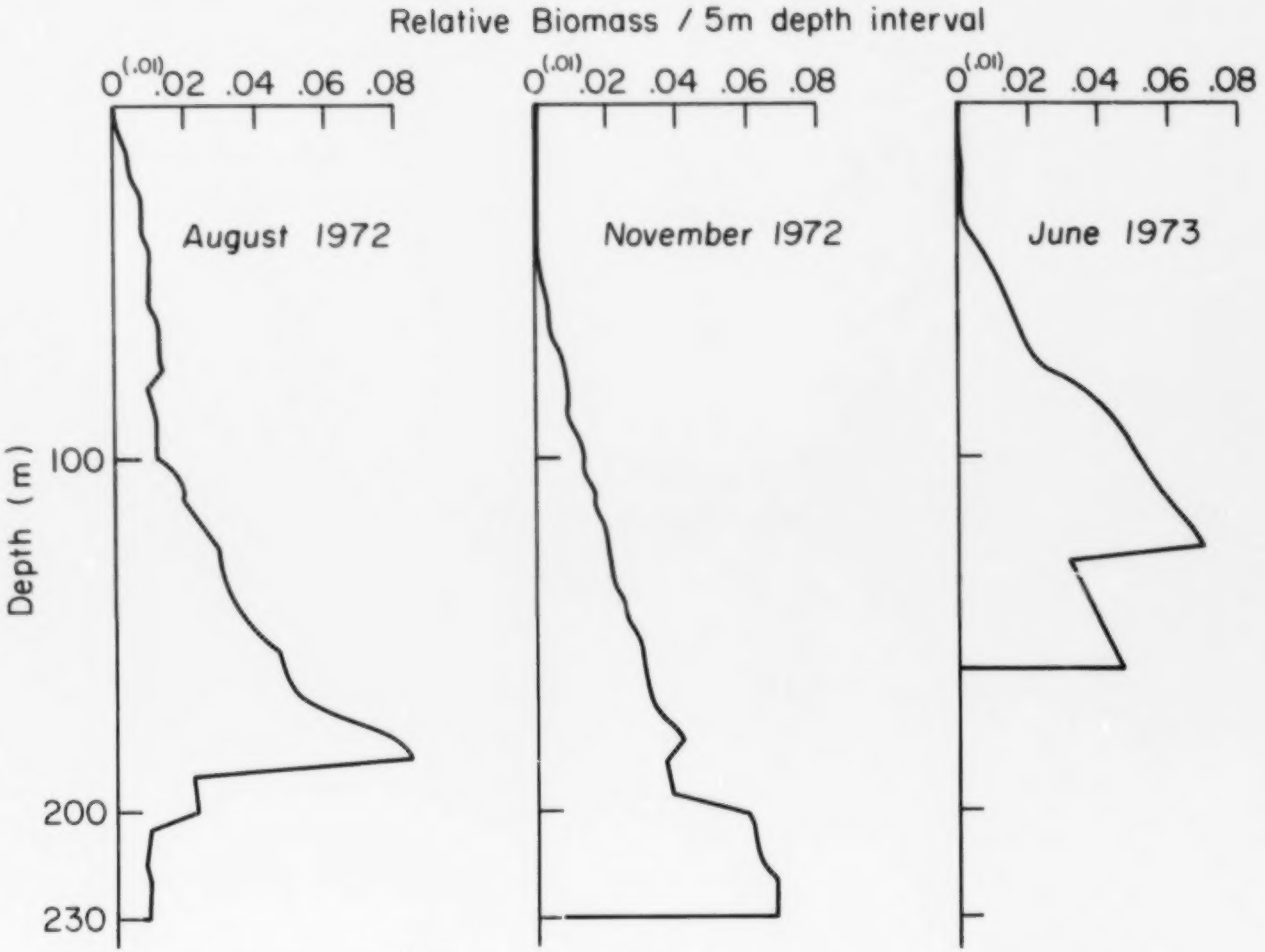

Figure 15. Relative biomass (%) per 5 m interval versus depth (m) for 21 - 25 August 1972, 30 October - 3 November 1972, and 12 - 16 June 1973

Table 12. ACOUSTIC REFLECTIVITY (D.C. VOLTS/m^3), ESTIMATED COLUMN BIOMASS (g dry wt/m^2), COLUMN VOLUME (m^3) AND BIOMASS PER UNIT VOLUME (g dry wt/m^3) FOR ALL STATIONS, LAKE ONTARIO, AUGUST 1972.

Field St.	Acoustic Biomass (120-200-500)	Total Column Biomass g dry wt/m^2 (from regression)	Volume depth m (x 1m^2)	Unit Volume Biomass g dry wt/m^3
1	11.15	151.541	30	5.05
2	1.77	24.629	15	1.64
3	13.79	187.260	20	9.36
5	74.00	1,001.901	95	10.54
7	6.38	87.002	25	3.48
8	46.38	628.20	70	8.97
10	50.58	685.03	115	5.95
12	8.21	111.76	20	5.59
14	1.26	17.73	10	1.77
15	59.04	799.49	100	7.99
17	95.98	1,299.29	130	9.99
19	1.22	17.19	10	1.72
20	1.70	23.68	15	1.58
24	30.91	418.80	110	3.80
26	83.79	1,134.36	145	7.82
30	11.37	154.52	20	7.73
31	49.45	669.74	25	26.78
32	429.94	5,817.77	170	34.2
34	24.95	338.26	85	3.98
35	14.62	198.49	25	7.94
36	20.08	272.36	30	9.07
38	131.13	1,774.87	125	14.19
40	153.03	2,071.18	170	12.18
41	6.23	84.97	25	3.40
42	3.55	48.71	15	3.24
44	367.88	4,978.10	170	29.2
45	350.11	4,737.67	200	23.68
46	86.43	1,170.08	120	9.75
48	8.63	117.45	25	4.70
49	1.90	26.39	20	1.32
52	14.17	192.40	65	2.95
54	111.64	1,511.17	135	11.19
56				
59	2.98	41.00	25	1.64
60	1.58	22.06	10	2.21
62	91.25	1,235.29	165	7.48
64	51.55	698.15	85	8.21
66	4.03	55.21	25	2.20
67	2.71	37.35	20	1.87

Table 12 (continued). ACOUSTIC REFLECTIVITY (D.C. VOLTS/m^3) ESTIMATED COLUMN BIOMASS (g dry wt/m^2), COLUMN VOLUME (m^3) AND BIOMASS PER UNIT VOLUME (g dry wt/m^3) FOR ALL STATIONS, LAKE ONTARIO, AUGUST 1972.

Field St.	Acoustic Biomass (120-200-500)	Total Column Biomass g dry wt/m^2 (from regression)	Volume depth m (x 1m^2)	Unit Volume Biomass g dry wt/m^3
69	76.79	1,039.65	150	6.92
71	474.84	6,425.27	185	34.73
72	23.05	312.55	30	10.4
73	1.97	27.34	15	1.82
75	75.65	1,024.23	230	4.45
78	65.26	883.649	50	17.66
79	13.41	182.19	20	9.1
83	4.22	57.78	95	0.61
85	1,924.05	26,033.08	185	140.7
89	400.82	5,423.78	75	72.3
90	4.09	56.02	10	5.60
92	83.09	1,124.89	65	17.3
94	15.45	209.72	35	5.99
96	9.23	125.56	35	3.59
97	.34	5.28	15	.35
98	6.82	92.96	25	3.71
99	36.17	490.06	20	24.5
103	.85	12.18	40	.30
105	9.19	125.02	20	6.25
95	11.73	159.39	25	6.37
			$\frac{687.01}{58}$	11.84 g dry wt/m^3

(Mean for lake, all depth)

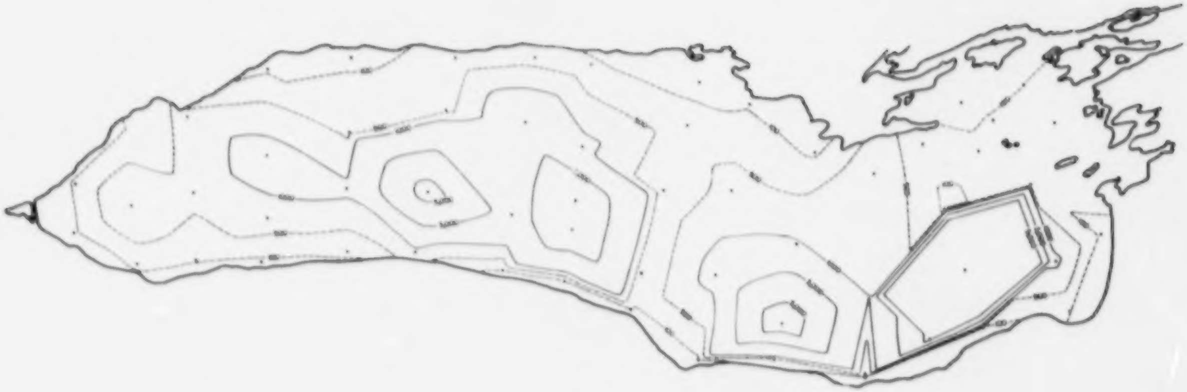

Figure 16. Column biomass (g dry wt/m^2) during August 1972

HORIZONTAL DISTRIBUTIONS OF ZOOPLANKTON BIOMASS (ACOUSTICAL EST.)

Detailed analysis of horizontal distribution of column biomass (zooplankton g dry-wt/m^2).

21-25 August 1972 ---

The lakewide distribution of zooplankton biomass reached a maximum during late summer 1972 (August). As expected the largest biomass per surface area was in deepwater. During 21-25 August 1972, notable concentrations of biomass were observed at stations 85 and 89 in eastern Lake Ontario and stations 32, 44 and 45 in western Lake Ontario (Figure 16). The mean biomass per unit volume of lakewater, considering all stations at all depths, was estimated to be 11.84 g dry wt/m^3. This very high value resulted, as indicated in the previous section, as a result of a large acoustical reflectivity from targets located at 100 - 200 m depth (Table 12).

5-9 February 1973 ---

The lakewide distribution of zooplankton biomass in February 1973 was, as expected, lower than in August 1972, but again greatest in deepwater. Three large cells are noted (Figure 17), one in the mid-western section of the lake with a large area greater than 500 g/m^2, one in midlake off Rochester, with 300 g/m^2, and one in eastern midlake with a biomass of 150 g/m^2. A single large inshore area of high zooplankton biomass was observed off the Oswego River, with a small area greater than 150 g/m^2, rather high for shallow water (Table 13).

June 1973 ---

By June 1973 the lakewide biomass had increased to a mean of 3.0 gm dry wt/m^3 (per unit volume), as shown in Table 14. Two large cells were located in western Lake Ontario, centered upon stations 10 and 32. An inshore cell was located west of Rochester, centered on station 56, and a high concentration of particles was observed in Mexico Bay. Again the general principal of a predominantly deepwater distribution of biomass is evident (Figure 18).

Comparison with Previous Estimates of Zooplankton Biomass

Zooplankton biomass estimates for Lake Ontario were made by Watson (1974) from animals taken in vertical tows from 50 m to the surface (Table 15). It is immediately obvious that our estimates are about 100x those made previously. This is because (a) the efficiency of net sampling, about [illegible], was not considered, and (b) because we have placed much of the biomass (estimated acoustically) below 50 m. It is necessary at this time that our acoustical estimates be considered preliminary. But they should provide a considerable stimulus to verify or deny the existence of considerable zooplankton biomass at depths greater than 100 m in Lake Ontario.

Table 13. ACOUSTICAL REFLECTIVITY (D.C. VOLTS/m^3), ESTIMATED COLUMN BIOMASS (g dry wt/m^2), COLUMN VOLUME (m^3) AND BIOMASS PER UNIT VOLUME (g dry wt/m^3) FOR ALL STATIONS, LAKE ONTARIO, FEBRUARY 1973.

Field St.	Acoustic Biomass (120-200-500)	Total Column Biomass (g dry wt/m^2) (from regression)	Volume (m^3) depth m (x1 m^2)	Unit Volume Biomass g dry wt/m^3
1	5.07	69.27	30	2.31
3	.57	8.39	20	.42
5	.20	3.39	95	.04
8	0.	0.		0.
14	1.62	15.21	10	1.52
15	5.43	96.06	100	.96
20	9.35	127.19	15	8.47
24	0.	0.		0.
26	0.	0.		0.
30	11.85	161.01	20	8.05
31	7.83	106.62	25	4.26
32	76.31	1,033.15	170	6.07
34	12.22	166.01	85	1.95
35	.57	8.39	25	.34
42	10.02	136.25	15	9.08
44	0.	0.		0.
46	10.05	136.65	210	1.13
48	9.21	125.29	25	5.01
60	1.81	25.16	10	2.51
62	50.22	680.15	165	4.12
64	23.68	321.07	85	3.77
66	6.19	84.43	25	3.37
73	7.31	99.58	15	6.63
77	.21	3.52	117	.03
75	0.	0.	230	0.
78	4.16	56.96	50	1.13
79	.82	11.77	20	.59
83	11.74	159.52	95	1.68
85	0.	0.		0.
89	0.	0.		0.
90	16.52	224.19	10	22.4
92	3.23	44.38	65	.68
95	0.	0.		0.
105	0.	0.		0.
				96.52

$$\frac{96.52}{33} = 2.92$$

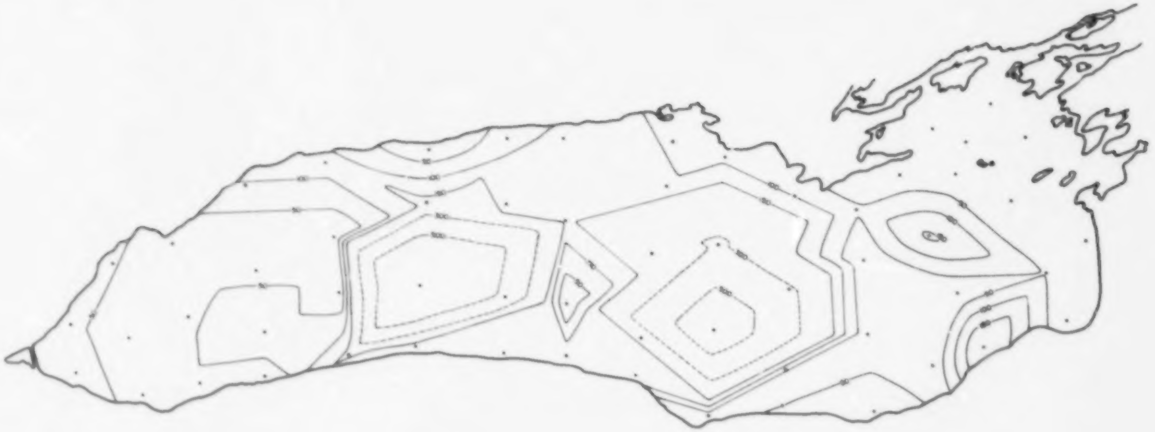

Figure 17. Column biomass (g dry wt/m^2) during February 1973

Table 14. ACOUSTICAL REFLECTIVITY (D.C. VOLTS/m^3), ESTIMATED COLUMN BIOMASS (g dry wt/m^2), COLUMN VOLUME (m^3) AND BIOMASS PER UNIT VOLUME (g dry wt/m^3) FOR ALL STATIONS, JUNE 1973.

Field St.	Acoustic Biomass (120-200-500)	Biomass mg dry wt (from regression)	Volume of depth (x1 m^2=m^3)	Unit Volume Biomass g dry wt/m^3
1	0.0	0.681	30	.02
2	0.0	0.681	15	.02
3	0.0	0.681	20	.02
5	5.3	72.39	95	.76
7	14.9	202.28	25	8.09
8	22.51	305.24	70	4.36
10	84.16	1,139.37	115	9.90
12	0.0	0.681	20	.03
14	0.94	13.40	10	1.34
19	0.0	0.681	10	.07
20	2.08	28.82	15	1.92
24	38.57	522.53	110	4.75
26	53.14	719.67	145	4.96
30	2.51	34.64	20	1.73
31	12.18	165.48	25	6.60
32	127.75	1,729.14	170	10.17
35	1.37	19.22	25	.77
36	3.14	43.17	30	1.43
41	0.0	0.681	25	.03
42	24.81	336.36	15	22.42
46	8.33	113.39	120	.94
48	4.22	57.78	25	2.31
56	145.49	1,969.16	129	15.26
59	0.0	0.681	25	.03
60	0.47	7.04	10	.70
62	10.73	145.86	165	.88
64	0.0	0.681	85	.00
66	0.0	0.681	25	.03
67	0.0	0.681	20	.03
72	0.0	0.681	30	.03
73	0.0	0.681	15	.05
75	0.0	0.681	230	.00
78	0.97	13.81	50	.28
79	1.46	20.44	20	1.02
89	0.16	2.846	75	.04
90	0.0	0.681	10	.07
92	55.90	757.01	65	11.64
94	10.19	138.55	35	3.95
96	4.64	63.46	35	1.81

Table 14 (continued). ACOUSTICAL REFLECTIVITY (D.C. VOLTS/m^3), ESTIMATED COLUMN BIOMASS (g dry wt/m^2), COLUMN VOLUME (m^3) AND BIOMASS PER UNIT VOLUME (g dry wt/m^3) FOR ALL STATIONS, JUNE 1973.

Field St.	Acoustic Biomass (120-200-500)	Biomass mg dry wt (from regression)	Volume of depth (x1 m^2=m^3)	Unit Volume Biomass g dry wt/m^3
97	2.80	38.57	15	2.57
77	7.84	106.76	121	.88
95	9.76	132.73	25	5.30
				127.19

$\frac{127.19}{42}$

mean = 3.02

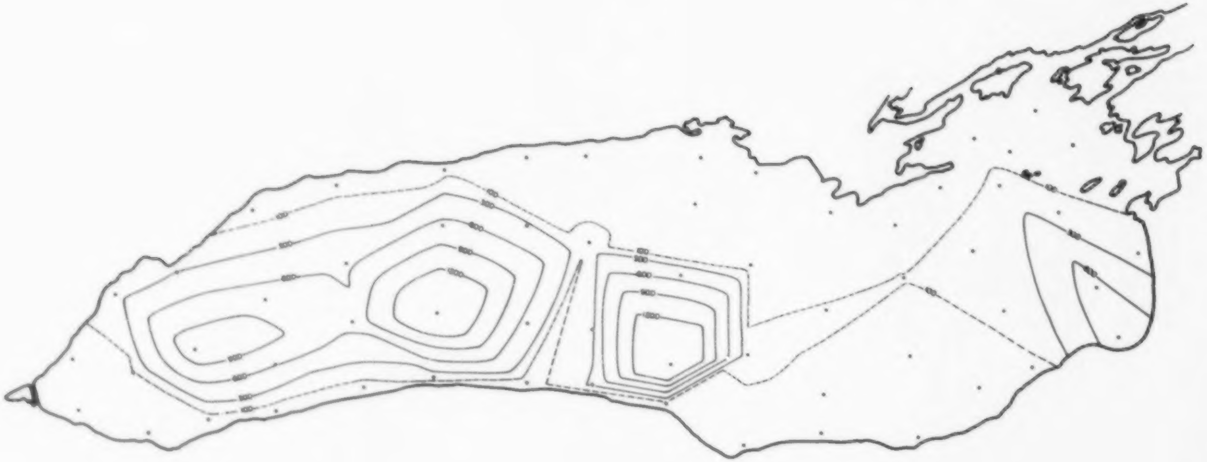

Figure 18. Column biomass (g dry wt/m^2) during June 1973

Table 15. COMPARISON OF ACOUSTICAL BIOMASS ESTIMATES (g dry-wt/m^3) OVER ENTIRE WATER COLUMN, WITH OTHER ESTIMATES (g dry-wt/m^3) OVER 0 - 50 m COLUMN.

Comparable Dates	Previous Estimate (Watson, 1974)	Acoustical Biomass Estimate	Ratio Acoustical:Previous Estimates
17-21 August 1970 (Watson) August 1972	.16	11.8	73.8:1
3-8 February 1970 (Watson) February 1973	.02	2.9	145:1
22-27 June 1970 (Watson) June 1973	.03	3.0	100:1

SECTION VII

COMPARATIVE MATHEMATICAL ANALYSIS OF ZOOPLANKTON COMMUNITIES

INTRODUCTION

One of the important topics of ecology is the comparison of different communities. Communities found in similar environments as well as those occupying very different environments can be compared for species composition, species interactions and mass and energy flow, as well as other community properties. Comparison can be descriptive and qualitative, or some quantitative measures of community structure and the roles of species can be developed.

This study utilizes the competition matrix by Levins (1968) as a model from which to develop such measures. A very simple definition of community is implied by this model, simply a group of species interacting at a time and place --- the question of whether the community is a natural biological unit (Poole, 1974) is of no concern.

The use of the competition matrix restricts the concept of community to a group of competitors and therefore to essentially one trophic level. This study considers a community consisting of only the dominant herbivorous zooplankters as the cladocerans, *Daphnia galeata*, *Daphnia longiremis*, *Bosmina*, *Diaphanosoma*, and the calanoid copepods, *Diaptomus minutus* and *Diaptomus sicilis*. Omnivores and carnivores are excluded from the model.

Three different levels of community structure are investigated with measures developed from the competition matrix. First, the individual interactions between species can be considered. Then the importance of each species in terms of competition levels can be investigated. Finally, at the community level, the average intensity of competition and community stability can be studied.

Additional measures not directly related to the competition matrix are also considered in this study. Niche breadths, as a property of species, and community diversity, a community property, are essentially information measures which can be applied to comparing communities.

Utilizing these measures of the entire community the following hypothesis can be investigated: During the period between spring and fall turnovers of the lake the zooplankton community evolves toward reduced competition, increased stability and increased diversity.

The competition matrix is based on a model of interacting species first used by Volterra (1926). This model has been given two interpretations. First, it can be considered as a simple model of population dynamics in its own right. Secondly, it can be viewed as an approximation to certain more complex models in some region around equilibrium. It is this latter interpretation which we are considering here with the resulting limiting assumption that the community under consideration is always in a near equilibrium state. For this reason the zooplankton communities considered all occur at summer dates when the equilibrium conditions are more nearly met.

MATHEMATICAL THEORY

Competition Matrix

The competition matrix arises from the Volterra (1926) system for m interacting species

$$n_i = \frac{P_i}{k_i}\left(k_i - \sum_{j=1}^{m} \alpha_{ij} n_j\right) n_i ; \quad \alpha_{ii} = 1; \; i = 1,2,\text{---}m \qquad (1)$$

where n_i - population density of the ith species
P_i - intrinsic growth rate of the ith species
k_i - carrying capacity of the ith species
α_{ij} - competition coefficient jth species on the ith species

α_{ij} measures the number of individuals of species, i, displayed by one individual of species, j, when the system is near equilibrium. The α_{ij} can be grouped in an array known as the competition matrix (Levins, 1968). This matrix, A_α, is of the form

$$A_\alpha = \begin{bmatrix} \alpha_{11} & \alpha_{12} & \cdots & \alpha_{1m} \\ \alpha_{21} & & & \vdots \\ \vdots & & & \vdots \\ \alpha_{m1} & \cdots & \cdots & \alpha_{mm} \end{bmatrix} \qquad (2)$$

and contains information on competition between individuals of different species.

The α_{ij} measure the displacement of species i per individual of species j. It is often of more interest to consider the displacement of species i due to the entire population of species j. If we let $\hat{n}_j$ represent the equilibrium population of species j, then $\alpha_{ij}\hat{n}_j$ would be a measure of this displacement. We can think of this as weighting each element α_{ij} by the population density $\hat{n}_j$. In order that the new elements be scaled similarly to α_{ij}, a normalizing factor $(\hat{n}_{ave})^{-1}$, where $\hat{n}_{ave} = \frac{1}{m}\sum_{j=1}^{m} \hat{n}_j$, is used and an adjusted competition matrix A^1 is formed with elements

$$\alpha_{ij} = \frac{\hat{n}_j}{\hat{n}_{ave}} \alpha_{ij} \tag{3}$$

These elements indicate the relative competitive impact of species j on species i.

While a comparison of communities can be made using the α_{ij} or α^1_{ij} values directly, data reduction techniques can often facilitate the analysis. A number of these techniques are based on averaging over the competition matrix in different fashion.

Vandermeer (1972a) suggested two approaches. First is the row average, which he termed the community effect. It measures the competition faced by a species. The ith row average, $\overline{\alpha}_{i\cdot}$ (or $\overline{\alpha^1}_{i\cdot}$), is defined as

$$\overline{\alpha}_{i\cdot} \underline{\Delta} \frac{1}{m} \sum_{j=1}^{m} \alpha_{ij} \tag{4}$$

(where $\underline{\Delta}$ means "is defined as")

A second measure is the column average, termed the species effect. This is defined as

$$\overline{\alpha}_{\cdot j} \underline{\Delta} \frac{1}{m} \sum_{i=1}^{m} \alpha_{ij} \tag{5}$$

and similarly for α^1_{ij}. This measures the impact of a species on the community. $\overline{\alpha^1}_{\cdot j}$ can be written

$$\overline{\alpha^1}_{\cdot j} = \left(\frac{\sum_{i=1}^{m} \alpha_{ij}}{m\hat{n}_{ave}}\right) \hat{n} \tag{6}$$

and considered to be a normalized effective population density (normalized by $\hat{n}_{ave}$), where effective refers to competitive impact. This measure is useful in rank ordering species in terms of their importance in the community as a function of competition.

Row and column averages are species' properties and can be used in comparing the roles of species within and between communities. Another species measure, not a function of the α's, is niche breadth. If species i has a one dimensional niche divided into r micro-environments and p_{ik} is the proportion of the species utilizing the kth environment, then

$$\beta_i = \frac{1}{\sum_{k=1}^{r} p_{ik}^2} \tag{7}$$

is a measure of niche breadth (Levins, 1968). For a two dimensional niche such as is used in this study the relationship becomes

$$\beta_i = \frac{1}{\sum_{k=1}^{r} \sum_{\ell=1}^{s} p_{ik\ell}^2} \tag{8}$$

If the two dimensions are independent equation (8) can be written

$$\beta_i = \frac{1}{\sum_{k=1}^{r} \sum_{\ell=1}^{s} (p_{ik}^{(1)} \, p_{i\ell}^{(2)})^2} \tag{9}$$

Properties of whole communities can be measured as well. Levins (1968) suggested the average α as a measure of niche separation in the community. This parameter,

$$\bar{\alpha} \triangleq \frac{1}{m^2} \sum_{i=1}^{m} \sum_{j=1}^{m} \alpha_{ij} \tag{10}$$

is a measure of average species co-occurrence in Levins' original formulation. $\bar{\alpha}^1$, analogous to $\bar{\alpha}$, is a community measure of competition in the present formulation.

Diversity is another example of a community property and is often measured by the Shannon-Weaver information measure, $\bar{d}$, community diversity, is defined as

$$\bar{d} \triangleq - \sum_{j=1}^{m} \frac{\hat{n}_j}{\sum_i \hat{n}_i} \ln \frac{\hat{n}_j}{\Sigma n_i} \tag{11}$$

Utilizing $\bar{\alpha}^1_{\cdot j}$ as a weighted version of $\hat{n}_j$, a second diversity index, $\bar{d}^1$, can be formed in a way analogous to equation (11).

We now have four community measures. $\bar{\alpha}$ depends on niche structures and is essentially independent of population densities. $\bar{d}$, on the other hand, is a measure of population densities and does not depend on niche structure. $\bar{\alpha}^1$ and $\bar{d}^1$ are both mixed measures, including information on niche structure and population densities.

System Matrix

If we are interested in the dynamics of a community in a near equilibrium state and particularly in its local stability, analysis of the system matrix is required. To determine this matrix the system is linearized around its equilibrium point. The linearized system is

$$\dot{n}_i = \sum_{j=1}^{m} \alpha_{ij} (n_j - \hat{n}_j); \; i = 1,2,\text{---}m \qquad (12)$$

where the α_{ij} are defined as

$$\alpha_{ij} \triangleq \frac{\alpha}{\alpha \hat{n}_j} \left\{ \frac{p_i}{k_i} \left(k_i - \sum_{\ell=1}^{m} \alpha_{i\ell} n_\ell\right) n_i \right\} \Big|_{n_i = \hat{n}_i} . \qquad (13)$$

The resultant value of α_{ij} is

$$\alpha_{ij} = \frac{p_i \hat{n}_i}{k_i} \alpha_{ij} \quad . \qquad (14)$$

The α_{ij} form the elements of A, the system matrix. A and A_α are related by a simple matrix transformation. If D is a diagonal matrix (all zeros except along the main diagonal) and the diagonal elements are $d_{ii} = -\frac{p_i n_i}{k_i}$, then A = DA.

Equation (12) can be re-written in matrix form as

$$\dot{\underline{n}} = A(\underline{n} - \hat{\underline{n}}) \qquad (15)$$

The solution for $\underline{n} - \hat{\underline{n}}$, valid only near $\hat{\underline{n}}$, is of the form

$$\underline{n} - \hat{\underline{n}} = \sum_{k=1}^{m} \underline{c}_k e^{\lambda_k t} \qquad (16)$$

Where the m values λ_k, known as the eigenvalues of the system matrix A, are the roots of the equation

$$|A - \lambda I| = 0. \qquad (17)$$

I is the identity matrix and $|A-\lambda I|$ is the determinant of $A-\lambda I$.

The stability of the equilibrium depends on the eigenvalues. If any λ_k has a positive real part the equilibrium is unstable. Thus, if we designate by λ_{max} the eigenvalue with the largest real part, λ_{max} seems a good measure of community stability (May, 1973). We shall return to this point later.

The Competition Coefficient

Basic to both the competition matrix and the system matrix is the competition coefficient. Levins (1968) initially used as an approximation to competition the probability of co-occurrence, essentially a niche overlap model of competition. Levins (Lane, 1971) and others (MacArthur, 1972; May, 1973; Schoener, 1974; Vandermeer, 1972b) have discussed other forms of niche overlap models. This study will utilize a rather simple form.

Assume initially a one dimensional resource spectrum, $\hat{R}_1$, $\hat{R}_2$, $\hat{R}_p$, where $\hat{R}_k$ is the equilibrium density (or standing crop) of the kth resource group. Let ϕ_{ik} be the rate per unit density at which species i utilizes resource k. Then $\sum_{k=1}^{p} R_k \phi_{ik}$ represents the resources utilized by species i at equilibrium. ϕ_{ik} can be expressed as $s_i p_{ik}$ where $\sum_{k=1}^{p} p_{ik} = 1$.

s_i, a magnitude term, is determined by filtering rates in this study.

A simple measure of niche overlap for species i and j is $\sum_{k=1}^{p} \hat{R}_k \phi_{ik} \phi_{jk}$.

In order to equate niche overlap as competition coefficients with their requirement that $\alpha_{ii} = 1$, a normalizing factor is needed, leading to

$$\alpha_{ij} = \frac{\sum_{k=1}^{p} \hat{R}_k^2 \phi_{ik} \phi_{jk}}{\sum_{k=1}^{p} \hat{R}_k^2 \phi_{ik}^2} \qquad (18)$$

This can be re-written as

$$\alpha_{ij} = \frac{s_j \sum_{k=1}^{p} \hat{R}_k^2 p_{ik} p_{jk}}{s_i \sum_{k=1}^{p} \hat{R}_k^2 p_{ik}^2} \qquad (19)$$

The model developed for herbivorous zooplankton considers a two-dimensional resource spectrum (or niche). These dimensions are known as habitat selection and resource allocation (Lane, 1971). Habitat selection refers to the vertical distribution of zooplankton species in the water column and overlap in this niche dimension is co-occurrence. Resource allocation refers to size-selective feeding by the zooplankton (Burns, 1968; Wilson, 1973). In turn the density of the resources, largely phytoplankton, must be described in terms of both vertical distribution and size distribution. The resource is now described as $\hat{R}_{k\ell}$ and the utilization function as $\phi_{ik\ell}$. As discussed for niche breadth, if it is assumed that the dimensions are independent $\hat{R}_{k\ell}$ and $\phi_{ik\ell}$ can be written as $R_k^{(1)} R_\ell^{(2)}$ and $\phi_{ik}^{(1)} \phi_{i\ell}^{(2)}$. Equation (19) becomes

$$\alpha_{ij} = \frac{s_j \sum_{k=1}^{p} \sum_{\ell=1}^{q} (\hat{R}_k^{(1)} \hat{R}_\ell^{(2)})^2 \, P_{ik}^{(1)} P_{i\ell}^{(2)} P_{jk}^{(1)} P_{j\ell}^{(2)}}{s_i \sum_{k=1}^{p} \sum_{\ell=1}^{q} (\hat{R}_k^{(1)} \hat{R}_\ell^{(2)})^2 (P_{ik}^{(1)} P_{i\ell}^{(2)})^2} \qquad (20)$$

This is the form of α_{ij} used in this study.

Thus we have developed a new approach to examining community interactions, which should in the future replace the α-analysis used in this study (Section V).

SECTION VIII

A HYPOTHESIS ON CALANOID SUCCESSION TO CLADOCERANS DURING EUTROPHICATION

INTRODUCTION

Changes in the species composition of the crustacean zooplankton have long been used as an indication of the increased eutrophication of freshwaters. The best known indicator, *Bosmina longirostris*, was observed to replace the larger *B. coregoni* after 50 years of enrichment of the Zurichsee (Minter, 1938). *B. longirostris* likewise replaced *B. coregoni* in Linsley Pond following a period of increased productivity (Deevey, 1942).

In the Laurentian Great Lakes a complicated series of changes have been detailed. In Lake Michigan the cladocerans *Daphnia retrocurva* and *D. galeata* dominated in 1927 (Brooks, 1969) and 1954 (Wells, 1960), gave way to the smaller and likely more predation-free *D. longiremis* by 1966, while *D. retrocurva* was again dominant by 1968 (Wells, 1970). Likewise, *Leptodora kindtii*, the largest cladoceran, was common in 1954, rare in 1966 and common again by 1968, as were the large calanoids *Limnocalanus macrurus*, *Epischura lacustris*, and *Diaptomus sicilis* (Wells, 1960 and 1970). Such data have been interpreted as a response to high alewife predation through 1966 (Brooks, 1969), with a return to 1954-like populations following the alewife dieoff after 1966 (Wells, 1970). By 1972, *Bosmina longirostris* and *Cyclops bicuspidatus* were dominant (Roth and Stewart, 1973).

Similarly, in Lake Ontario *Diaptomus* and *Daphnia* were abundant in 1939, whereas *Cyclops bicuspidatus* and *Bosmina longirostris* took over as in Lake Michigan by 1969 (McNaught and Buzzard, 1973). *Bosmina* is now especially abundant inshore and nearby urban areas (McNaught, 1974). In Lake Erie similar communities were dominated by *D. galeata* in 1938, with *D. retrocurva* second (Chandler, 1940), whereas by 1959 the smaller *D. retrocurva* had succeeded (Bradshaw, 1964). Again we could have interpreted these observations as evidence of size-selective predation, but in my opinion the size spectrum of food resources must also be considered.

Clearly a better understanding of eutrophication will result from a greater knowledge of selective factors governing changes in species composition. Brooks (1969) has suggested that, in addition to enrichment, planktivory by fishes and zooplankton filtering capacity are primary factors in species succession. But additional factors under two following headings are also vital; all emphasize the nutritional aspects of a nutritionally dilute environment:

I. Evolutionary responses to variable phytoplankton foods.

   A. evolution of generalists and specialists with regard to selective algal grazing by zooplankton
   B. evolution for increased filtering capacity
   C. evolution for increased ingestion rate and efficiency, both by size and density of algae
   D. evolution toward increased efficiency of digestion

II. Evolutionary responses to fish predation.

   A. evolution for small adult size at maturity
   B. evolution of biotic potential (r-selection organisms with high intrinsic birth rates (b_{max}) or low death rates)
   C. evolution for reduced visibility, especially of larger adults.

EVIDENCE FOR EVOLUTIONARY TRENDS

From studies of zooplankton feeding it has been evident that some oligotrophic forms are nannoplankton specialists, while many eutrophic species are generalists. But little argument exists regarding whether zooplankton are size-selective feeders. Calanoid copepods are specialists on nannoplankton, as confirmed by field studies. *Eudiaptomus* in Lake Erken preferred nannoplanktonic chrysomonads (Nauwerck, 1963). Similarly 70% of the diet of *Diaptomus* consisted of phytoplankton of less than 64μ diameter in one study (Lane, 1971), while in another most was less than 22μ (Bogdan and McNaught, 1974). In contrast, *Bosmina longirostris* had a preferred range of particles in the nannoplankton category (1 - 15μ) according to Gliwicz (1969), but has also been observed to consume a sizeable percentage (50%) of cells above 64μ (Lane, 1971). These differences in size will be used to calculate grazing (Table 16).

Thus each organism has been given an *adaptive value* within the framework of lake productivity. In actual application here, the relative values for each of the 8 components to which the zooplankton show adaptation are summed to determine the adaptive value. The 8 components had relative values from 5 to 100 and the resulting *adaptive values* for *Diaptomus*, *Daphnia* and *Bosmina* range from 346 to 642 (Table 16).

The advantages of increased filtering capacity were discussed by Brooks (1969), who found that filtering capacity increased as the square of body length (Brooks and Dodson, 1965). Indeed the larger *Daphnia* filtered nannoplankton at the same rate as *Diaptomus* (Table 16), while *Bosmina longirostris* lagged on all resources (Bogdan, 1974). Dodson (1974) has suggested that the advantages of size and filtering capacity alone were not enough to insure survival.

The efficiency of ingestion appears to be a dominant factor in contrasting the evolution of feeding. Studies by McMahon and Rigler (1963) on

Table 16. GROWTH CHARACTERISTICS AND A GRAZING ESTIMATE FOR HYPOTHETICAL POPULATIONS OF ZOOPLANKTON IN AN OLIGOTROPHIC VERSUS A MESOTROPHIC LAKE. ACTUAL (PARENTHESES) AND RELATIVE VALUES FOR FEEDING.

	Oligotrophic (L. Superior)			Mesotrophic (L. Ontario)		
	Diaptomus	Daphnia	Bosmina	Diaptomus	Daphnia	Bosmina
I. Organismic Characteristics						
Feeding related						
Filtering rate (ml/an/day)	(.42) 100	(.42) 100	(.15) 36	(.42) 100	(.42) 100	(.15) 36
Ingestion rate with cell density (cells/an/day)	(1800) 100	(400) 22	(400) 22	(5000) 100	(1300) 26	(1300) 26
Ingestion efficiency with cell size (%)	(.016) 24	(.065) 100	(.065) 100	(.010) 10	(.065) 100	(.065) 100
Growth related						
Size at maturity (mm) (reciprocal)	(1.6) 0	(0.7) 0 (no predation)	(0.3) 0	(1/1.6) 19	(1/0.7) 42	(1/0.3) 100
Birth rate (b_{max})	(.14) 70	(.23) 100	(.22) 91	(.20) 70	(.33) 100	(.31) 91
Organismic Subtotal	294	322	249	305	368	353
II. Production and Grazing Factors						
Relative grazing per individual	(6.21) 100	(5.55) 89	(1.98) 31	(5.46) 30	(18.45) 100	(6.59) 36
Relative net production in ten days	(4.1) 41	(10.) 100	(9.0) 90	(1.6) 12	(10.) 74	(13.4) 100
Production-Grazing Subtotal, or Relative Grazing	(4100) 46	(8900) 100	(2790) 31	(373) 5	(7400) 100	(3600) 48
III. Adaptation Value	481	611	401	346	642	537

Daphnia magna and Richman (1966) on Diaptomus oregonensis have been compared (Figure 19). The ingestion rate (I_r) has been described by the above authors in terms of cells ingested, where:

$$I_r = \text{cells ingested/animal/day}$$

Thus Diaptomus feeding in a concentration of cells characteristic of oligotrophic lakes (925 cells/ml), ingested cells at a rate of 1800 cells/an/day (Figure 19). Daphnia, filtering at similar rates, would ingest only 400 cells/an/day. In contrast, at an mesotrophic concentration of 2600 cells/ml, these graphs would indicate an ingestion rate for Diaptomus of 5000 cells/an/day, while Daphnia would ingest 1300 cells/an/day. Clearly at oligotrophic and mesotrophic concentrations of planktonic algae, Diaptomus has a higher ingestion rate (Figure 19). Diaptomus thus has a higher ingestion efficiency at low densities. In these experiments, Daphnia was fed yeast and Diaptomus algae. While more such efficiencies must be determined for natural assemblages, these comparative results suggest that Diaptomus is adapted to existing on a more dilute food source than Daphnia, which is better adapted to the rigors of life in eutrophic waters, with its highly developed respiratory system.

Just recently, Bogdan and McNaught (1974) have examined ingestion efficiency with regard to the size of algal foods. Diaptomus, the nannoplankton specialist, is three times more efficient on nannoplankton (.016) than netplankton (.005), but Daphnia, the generalist, was equally efficient on both (.065 and .062). These findings again suggest Diaptomus to be well adapted to oligotrophy.

The last nutritional item, the evolution of the efficiency of digestion, relates to both the size and packaging of the algae resource. Recently Porter (1973) has found that green algae encased in thick gelatinous sheaths pass the gut of Daphnia galeata in viable condition. Much needs to be done relating the efficiency of digestion to size, packaging, available digestive enzymes, etc. and this parameter will not be given a value here.

Growth related responses have likely evolved with regard to fish predation. Evolution toward small size of the adult at the time of first brooding is of considerable benefit under heavy predation. We have examined the size of Diaptomus sicilis (1.6 mm), Daphnia galeata (1.0 mm), and Bosmina longirostris (0.26 mm) at the time of first birth. Quite obviously, Bosmina has a considerable advantage in this regard. Within genera, certain species also have an advantage, as B. longirostris is smaller than B. coregoni (0.5 mm) of oligotrophic waters, possibly one of the important factors explaining the often noted succession between these two species.

In a similar fashion, r-selection organisms can withstand considerable predatory pressure through a high intrinsic growth rate. Additionally, selection for high growth rate (r) in planktonic organisms has enabled

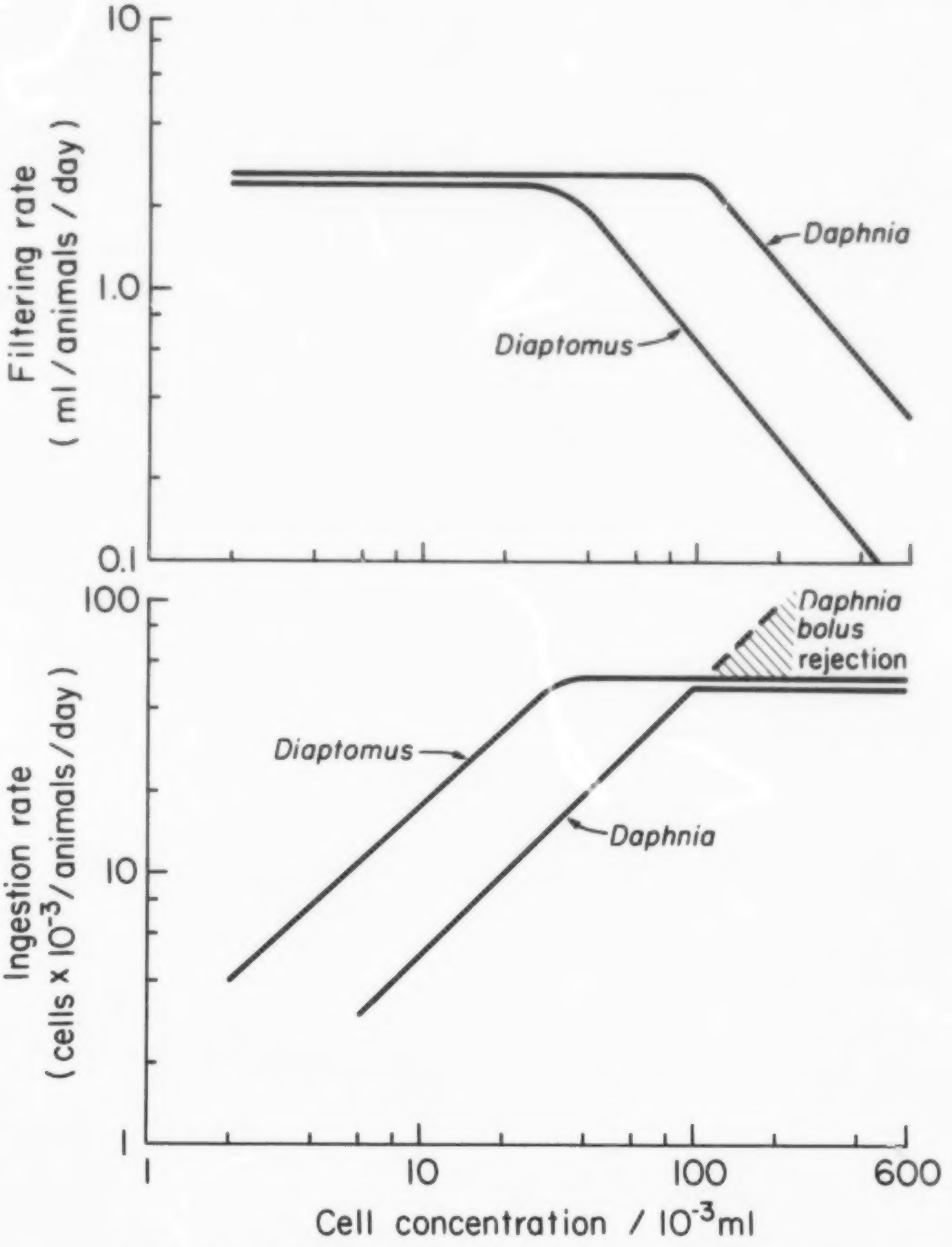

Figure 19. Filtering rate compared to food concentration for Daphnia (McMahon and Rigler, 1963) and Diaptomus (Richman, 1966) and ingestion rates at these same food concentrations

a rapid response to resource explosion. Our species have been calibrated using field data for *Daphnia galeata* (Hall, 1964) and *Diaptomus* and *Bosmina longirostris* (McNaught, unpublished). The significantly lower maximum birth rate for *Diaptomus* (Table 16) will likely become a limiting factor under eutrophic conditions.

Once the organismic factors had been described (Table 16, Section I), we proceed to give them relative values. However, it must be noted that individual feeding and growth factors have not been weighted. In nature some are certainly more important than others. In many cases, specific values for high or low foods were available. Potentially adaptive characteristics have been summarized (Table 16) by actual and relative value.

POPULATION GROWTH AND GRAZING

Determination of relative population growth and grazing in Lake Superior served as the calibration for our oligotrophic lake. During August three species of *Cyclotella* constituted 76% by density of the phytoplankton (Schelske, et al. 1972) and ranged in size from 2.5μ to 15μ in diameter. The remaining algae were predominantly flagellates. Thus the bulk of the phytoplankton was less than 15μ and fell in the 1 - 22μ category (Stoermer, 1973) while cell densities ranged from 350 - 1500 cells/ml.

Lake Ontario is the mesotrophic example. In August, the time of maximum phytoplankton standing crop, the plankton is evenly composed of chlorophytes (38%), cyanophytes (34%), cryptomonads (12%), dinoflagellates (12%) and chrysomonads (4%) (Munawar and Nauwerck, 1971). These forms ranged in size from 2 - 137μ in diameter, with almost all between 2 - 65μ, and the largest sub group of these between 2 - 22μ

To determine grazing, on an individual basis for each species, we have simply multiplied filtering rate (F) times the efficiencies for ingestion with size (E_s), times the ingestion rate (I_r) times the standing crop of phytoplankton (N_p), for Lake Superior within the 1 - 22μ size category (925 cells/ml) and for Ontario (Stoermer, 1973) within the 1 - 22μ (1300 cells/ml) and 22 - 65μ (1300 cells/ml) categories. This calibration suggests more *Bosmina* when netplankton is abundant, as Hrbáček *et al.* (1961) have observed. Thus relative grazing (G) is denoted:

$$G = F \cdot I_r \cdot E_s \cdot N_p \qquad (21)$$

To determine net production, we used the exponential growth equation:

$$N_t = N_o e^{rt} \qquad (22)$$

where N_t = number at time t, N_o = number at the onset, and r = the intrinsic growth rate. Furthermore:

$$r = b - d$$

where intrinsic birth rates (b) were used as designated in Table 7, and death rates for *Diaptomus* (0.10 ind/ind/day), *Daphnia* (0.5 ind/ind/day), and *Bosmina* (0.01 ind/ind/day) were based relative to size. Fish predation was considered negligible in Lake Superior, and high in Lake Ontario. Production was calculated for a period of 10 days, to illustrate the potential of these populations. Then to determine the impact of grazing, we simply multiplied the individual grazing rate (G) times herbivore abundance (N). As opposed to the organismic subtotal of relative values, we have termed this the Production-Grazing subtotal (Table 16, Section II).

Once each of these factors of evolutionary significance had been assigned a relative value, we applied the non-parametric Wilcoxon's paired, signed ranks test (Sokol and Rohlf, 1969) to see whether one column (components of adaptation for a species) was significantly different from another. Under oligotrophic conditions, *Diaptomus* totaled 481 pts., but was not significantly better adapted than *Bosmina* with 401 pts. ($T = 11$, $p > 0.1$); on the other hand, *Daphnia* was better adapted ($T = 0$, $p < 0.1$) than *Bosmina*. Under mesotrophic conditions, *Daphnia* was significantly ($T = 6$, $p < 0.1$) better adapted than *Diaptomus*, while *Bosmina* was not ($T = 9$, $p > 0.1$).

CONCLUSIONS

The sum total of all relative Organismic and Production-Grazing subtotals has been called the *Adaptation Value* (Table 16). These Adaptation Values suggest that *Diaptomus* would be successful in an oligotrophic lake like Superior, because of its superior filtering capacity and its high ingestion rate at low cell densities and high ingestion efficiency at small cell sizes. *Bosmina* was not predicted successful under similar conditions, because of its low filtering capacity.

In contrast, in mesotrophic Lake Ontario the feeding generalist, *Bosmina*, was predicted successful because of its ingestion efficiency on small and large cells alike, its small size at maturity, which reduces fish predation and its high intrinsic birth rate (b_{max}). Indeed, *Diaptomus sicilis* is the dominant organism in Lake Superior (Patalas, 1969), and occurs in all of the Great Lakes (Robertson, 1966), while *Bosmina longirostris* dominates in Lake Ontario (McNaught and Buzzard, 1973).

However, in both trophic simulations *Daphnia* was predicted more successful than observed in nature, due to its high filtering capacity, high ingestion efficiency on both small and large cells, and its high intrinsic birth rate. Clearly we have more to consider in this case. and possibly fish predation upon *Daphnia* has been undervalued. Also, *Daphnia retrocurva* and *Diaptomus* have been observed to co-occur, made possible through resource allocation (Lane and McNaught, 1973).

Regarding zooplankton succession, we have added the important concepts of ingestion rate with the size of food, and ingestion efficiency with the density of algae, to Brooks (1969) emphasis upon filtering capacity. Further investigation of feeding habits should detail the successes in the Great Lakes of species like *Daphnia retrocurva*, leading to a better understanding of eutrophication.

SECTION IX

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SECTION X

APPENDIX A

TABLES OF MEAN ZOOPLANKTON DENSITY BY SPECIES, DATE AND DEPTH OF WATER SAMPLED

Table 17. LAKEWIDE AVERAGE OF ZOOPLANKTON POPULATION DENSITIES. VALUES ($^n/m^3$) REPRESENT ANIMALS COLLECTED WITH A NET (64 APERTURE) AT STATIONS IN WATERS LESS THAN 30 m IN DEPTH, OVER A VERTICAL RANGE OF 0 - 5 m.

Species	15-19 May	12-16 June	10-14 July	21-25 Aug	Oct-Nov	Nov-Dec	5-9 Feb	19-22 March	24-28 April	12-16 June
Cladocera										
Bosmina coregoni	8	24	532	997	2755	978	24	19	7	52
Bosmina longirostris	48	382	11786	78230	1913	99	3	1	5	1755
Daphnia galeata	0	3	827	186	16	24	0.7	0.2	0.1	1.3
Daphnia retrocurva	6	6	55	10169	2001	352	0.6	0.1	0.7	18
Daphnia longiremis	0	0.05	15	0	0.4	0.2	0	0	0.4	0.2
Ceriodaphnia lacustris	0	1	23	4028	128	34	0	0	0.9	6
Chydorus sphaericus	0.1	3	94	213	35	41	0	0.05	0.3	7
Holopedium gibberum	0	0.1	0.9	17	1.3	0	0	0	0	0
Polyphemus pediculus	0	0	14	4	0	0	0	0	0	0
Diaphanosoma	0	0	0	10	0.2	0.7	0	0.5	0	0
Alona	0	0	0.6	0.2	3.5	18	0.2	0.05	0	0

Table 17 (continued). LAKEWIDE AVERAGE OF ZOOPLANKTON POPULATION DENSITIES. VALUES (n/m^3) REPRESENT ANIMALS COLLECTED WITH A NET (64 APERTURE) AT STATIONS IN WATERS LESS THAN 30 m IN DEPTH, OVER A VERTICAL RANGE OF 0 - 5 m.

Species	15-19 May	12-16 June	10-14 July	21-25 Aug	Oct-Nov	Nov-Dec	5-9 Feb	19-22 March	24-28 April	12-16 June
Cyclopoida										
Cyclopoida copepedites	70	431	1599	25331	10892	7146	2077	1407	987	13890
Cyclops bicuspidatus	740	1061	10707	8520	1054	519	126	232	887	529
Cyclops vernalis	1	6	91	737	176	849	10	7	22	81
Tropocyclops prasinus	0.5	4	26	1754	8022	1066	170	114	163	200
Calanoida										
Calanoida copepodites	37	57	113	130	405	170	41	69	108	219
Diaptomus ashlandi	0	0	0	0	0	0.2	1	0.5	0	.09
Diaptomus siciloides	0	0	0	0.3	4.9	6.8	0.04	0.2	0.3	0.5
Diaptomus minutus	114	132	53	60	30	35	37	49	43	29
Diaptomus oregonensis	15	22	26	46	47	60	42	8	20	1.3
Diaptomus sicilis	28	79	42	13	40	38	35	28	38	1.7
Limnocalanus macrurus	188	187	65	7	22	245	30	50	123	19
Eurytemora affinis	.08	9	10	1115	133	25	0.3	0	6	2.3

Table 18. MEAN ZOOPLANKTON POPULATION DENSITIES. VALUES (NUMBER/m^3) REPRESENT ANIMALS COLLECTED WITH A NET (64 u aperture).

Species	0-15m		0-10m		0-20m		0-25m		
	12-16 June	10-14 July	15-19 May	12-16 June	12-16 June	10-14 July	15-19 May	12-16 June	10-14 July
Cladocera									
Bosmina coregoni	35	87	14	81	3	107	6	9	76
Bosmina longirostris	323	9137	70	3909	235	10376	27	125	6049
Daphnia galeata	0	127	0.3	19	1	103	0.7	0.2	129
Daphnia retrocurva	8.5	14	6	2	4	39	1.4	5	57
Daphnia longiremis	0.4	0	0	0	0	0.4	0	0.4	2
Ceriodaphnia lacustris	1	37	0	0	0	40	0	0.3	37
Chydorus sphaericus	3	4	1	0.9	0.3	4	0.8	2	4
Holopedium gibberum	0	0	0	0	0	0	0	0	0
Polyphemus pediculus	0	0	0	0	0	0	0	0	0
Diaphanosoma	0	0	0	0.9	0	0	0	0	0
Alona	0	8	0	0	0	0	0.7	0.1	13

Table 18 (continued). MEAN ZOOPLANKTON POPULATION DENSITIES. VALUES (NUMBER/m^3) REPRESENT ANIMALS COLLECTED WITH A NET (64 u aperture).

	0-15m		0-10m		0-20m		0-25m		
Species	12-16 June	10-14 July	15-19 May	12-16 June	12-16 June	10-14 July	15-19 May	12-16 June	10-14 July
Cyclopoida									
Cyclopoid copepodites	580	2440	222	605	571	1599	161	362	1102
Cyclops bicuspidatus	166	5004	520	1332	562	4494	473	776	7929
Cyclops vernalis	10	52	0	16	7	102	1	12	100
Tropocyclops prasinus	17	55	1	21	28	76	0	1	42
Calanoida									
Calanoid copepodites	20	105	26	57	51	105	25	71	77
Diaptomus minutus	5	100	80	43	33	74	69	79	86
Diaptomus oregonensis	0.4	34	16		2	93	15	11	52
Diaptomus sicilis	0.5	39	14	0.9	17	25	14	29	46
Diaptomus ashlandi	0	0	0	0	0	0	0	0	0
Diaptomus siciloides	0	0	0	0	0	0	0	0.6	0
Limnocalanus macrurus	11	35	138	29	45	55		96	132
Eurytemora affinis	6	7	0	0	6	2	0	3	1
# of Stations	10	17		7	10	15	26	39	20

Table 19. MEAN ZOOPLANKTON POPULATION DENSITIES. VALUES (NUMBER/m^3) REPRESENT ANIMALS COLLECTED WITH A NET (64 APERTURE) AT STATIONS 50 m TO SURFACE.

Species	15-19 May	12-16 June	10-14 July	21-25 Aug	Oct-Nov	Nov-Dec	5-9 Feb	19-22 March	24-28 April	12-16 June
Cladocera										
Bosmina coregoni	1		5	157		176	14	0.7	.09	7
Bosmina longirostris	4		825	7399		35	1	1	0.2	185
Daphnia galeata	0		0.5	29		0.1	0.03	0	0	0
Daphnia retrocurva	0.4		0	1917		15	0.06	0.8	0.1	2
Daphnia longiremis	0		0	2		0.2	0	0	0	0.3
Ceriodaphnia lacustris	0		0	279		0.3	0	0	0	0
Chydorus sphaericus	0.1		0	2		0	0	0	0	0
Holopedium gibberum	0		0	0.5		0	0	0	0	0
Polyphemus pediculus	0		0	0.1		0	0	0	0	0
Diaphanosoma	0		0	0.5		0	0	0	0	0
Alona	0		0	0		0.1	0.03	0.1	0	0

Table 19 (continued). MEAN ZOOPLANKTON POPULATION DENSITIES. VALUES (NUMBER/m^3) REPRESENT ANIMALS COLLECTED WITH A NET (64 APERTURE) AT STATIONS 50 m TO SURFACE.

Species	15-19 May	12-16 June	10-14 July	21-25 Aug	Oct-Nov	Nov-Dec	5-9 Feb	19-22 March	24-28 April	12-16 June
Cyclopoida										
Cyclopoid copepodites	141		1363	8840		5753	2963	1181	511	2436
Cyclops bicuspidatus	608		2833	2604		69	25	92	562	250
Cyclops vernalis	0.3		59	453		0.4	0	0	0	0.2
Tropocyclops prasinus	0		54	190		576	163	79	89	23
Calanoida										
Calanoid copepodites	1099		76	58		119	35	52	82	126
Diaptomus ashlandi	0		0	0		.05	.02	0.2	0	0.2
Diaptomus siciloides	24		0	0.9		1	.06	0	0	0
Diaptomus minutus	87		17	18		23	2478	44	39	15
Diaptomus oregonensis	17		4	17		23	6	6	8	1
Diaptomus sicilis	14		29	6		20	8	9	8	2
Limnocalanus macrurus	182		196	84		57	16	82	147	143
Eurytemora affinis	0		5	22		4	0	0	0	0.1
# of Stations counted	16	0	4	20	0	20	14	17	17	17

SECTION X

APPENDIX B

ACOUSTICAL DATA BY STATION AND CRUISE FOR EACH 5 m DEPTH INTERVAL

```
1972 AUG STATION 1 DEPTH 33 METERS PREAMP 10**4 AVE 5 DEPTH 45
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-12     120-80  -.5643   200-120   .5874   500-200   .0915   5M
     CH  13-24     120-80 -1.0299   200-120   .9108   500-200   .2759  10M
     CH  25-36     120-80 -1.5346   200-120  1.1654   500-200   .4794  15M
     CH  37-48     120-80 -1.9403   200-120  1.4220   500-200   .6886  20M
     CH  49-60     120-80 -2.2065   200-120  1.6947   500-200   .8855  25M
     CH  61-72     120-80 -2.3221   200-120  1.9197   500-200  1.0674  30M
```

```
1972 AUG STATION 2 DEPTH 16 METERS PREAMP 10**4 AVE 5 DEPTH 22
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-24     120-80   .0983   200-120   .1698   500-200   .2730   5M
     CH  25-48     120-80   .1962   200-120   .0009   500-200   .5195  10M
     CH  49-72     120-80   .2941   200-120  -.2076   500-200   .8215  15M
```

```
1972 AUG STATION 3 DEPTH 22 METERS PREAMP 10** 4 AVE  DEPTH 25
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-22     120-80  -.8661   200-120  1.4906   500-200  -.3045   5M
     CH  23-44     120-80 -1.1103   200-120  2.3583   500-200  -.0124  10M
     CH  45-66     120-80 -1.9279   200-120  3.7986   500-200   .2769  15M
     CH  67-88     120-80 -2.7950   200-120  5.2875   500-200   .5655  20M
```

```
1972 AUG STATION 5 DEPTH 95 METERS PREAMP 10**4 AVE 5 DEPTH 120
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 4     120-80   .3357   200-120  -.0475   500-200   .2367   5M
     CH   5- 8     120-80   .4238   200-120   .0712   500-200   .4987  10M
     CH   9-12     120-80   .4475   200-120   .2511   500-200   .7778  15M
     CH  13-16     120-80   .4618   200-120   .4306   500-200  1.0670  20M
     CH  17-20     120-80   .4788   200-120   .6018   500-200  1.3620  25M
     CH  21-24     120-80   .4872   200-120   .7691   500-200  1.6621  30M
     CH  25-28     120-80   .4938   200-120   .9260   500-200  1.9516  35M
     CH  29-32     120-80   .5070   200-120  1.0752   500-200  2.2204  40M
     CH  33-36     120-80   .5191   200-120  1.2195   500-200  2.4838  45M
     CH  37-40     120-80   .5302   200-120  1.3599   500-200  2.7435  50M
     CH  41-44     120-80   .5297   200-120  1.4998   500-200  3.0027  55M
     CH  45-48     120-80   .5316   200-120  1.6348   500-200  3.2610  60M
     CH  49-52     120-80   .5456   200-120  1.7659   500-200  3.5204  65M
     CH  53-56     120-80   .5578   200-120  1.8958   500-200  3.7776  70M
     CH  57-60     120-80   .5682   200-120  2.0226   500-200  4.0364  75M
     CH  61-64     120-80   .5785   200-120  2.1468   500-200  4.2958  80M
     CH  65-68     120-80   .5836   200-120  2.2683   500-200  4.5563  85M
     CH  69-72     120-80   .5804   200-120  2.3883   500-200  4.8178  90M
     CH  73-76     120-80   .5800   200-120  2.5122   500-200  5.0774  95M
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1972 AUG STATION 7 DEPTH 26 METERS PREAMP 10**4 AVE 5 DEPTH 32
     MEAN VALUE ØF PRØFILES OVER 5M INTERVALS

     CH    1-16     120-80  -.8578   200-120  2.2553    500-200   .0629    5M
     CH   17-32     120-80   .6694   200-120  1.2019    500-200   .2717   10M
     CH   33-48     120-80  1.6884   200-120   .3961    500-200   .4961   15M
     CH   49-64     120-80  2.3643   200-120  -.1168    500-200   .7288   20M
     CH   65-80     120-80  2.7587   200-120  -.3537    500-200   .9637   25M

1972 AUG STATION 8 DEPTH 70 METERS PREAMP 10**4 AVE 5 DEPTH 78
     MEAN VALUE ØF PRØFILES OVER 5M INTERVALS

     CH    1- 6     120-80  -.7544   200-120  -.0040    500-200   .3683    5M
     CH    7-12     120-80  -.8572   200-120   .0854    500-200   .7349   10M
     CH   13-18     120-80  -.8782   200-120   .1730    500-200  1.1019   15M
     CH   19-24     120-80  -.8818   200-120   .2494    500-200  1.4749   20M
     CH   25-30     120-80  -.9070   200-120   .3502    500-200  1.8424   25M
     CH   31-36     120-80  -.9225   200-120   .4498    500-200  2.2119   30M
     CH   37-42     120-80  -.9237   200-120   .5330    500-200  2.5841   35M
     CH   43-48     120-80  -.9189   200-120   .6080    500-200  2.9556   40M
     CH   49-54     120-80  -.9222   200-120   .6800    500-200  3.3282   45M
     CH   55-60     120-80  -.9273   200-120   .7570    500-200  3.7016   50M
     CH   61-66     120-80  -.9311   200-120   .8307    500-200  4.0728   55M
     CH   67-72     120-80  -.9325   200-120   .9055    500-200  4.4454   60M
     CH   73-78     120-80  -.9383   200-120   .9836    500-200  4.8184   65M
     CH   79-84     120-80  -.9426   200-120  1.0599    500-200  5.1922   70M

1972 AUG STATION 10 DEPTH 119 METERS PREAMP 10**4 AVE 5 DEPTH 150
     MEAN VALUE ØF PRØFILES OVER 5M INTERVALS

     CH    1- 3     120-80   .0650   200-120  -.6737    500-200   .2155    5M
     CH    4- 6     120-80   .1426   200-120 -1.3181    500-200   .4146   10M
     CH    7- 9     120-80   .1504   200-120 -1.8966    500-200   .6016   15M
     CH   10-12     120-80   .1866   200-120 -2.5033    500-200   .7861   20M
     CH   13-15     120-80   .2012   200-120 -3.0897    500-200   .9701   25M
     CH   16-18     120-80   .2065   200-120 -3.6652    500-200  1.1493   30M
     CH   19-21     120-80   .2279   200-120 -4.2656    500-200  1.3285   35M
     CH   22-24     120-80   .2531   200-120 -4.8600    500-200  1.5059   40M
     CH   25-27     120-80   .3032   200-120 -5.4827    500-200  1.6852   45M
     CH   28-30     120-80   .4219   200-120 -6.1946    500-200  1.8621   50M
     CH   31-33     120-80   .5052   200-120 -6.8528    500-200  2.0379   55M
     CH   34-36     120-80   .5368   200-120 -7.4582    500-200  2.2156   60M
     CH   37-39     120-80   .5633   200-120 -8.0667    500-200  2.3916   65M
     CH   40-42     120-80   .6078   200-120 -8.6764    500-200  2.5671   70M
     CH   43-45     120-80   .6399   200-120 -9.2788    500-200  2.7418   75M
     CH   46-48     120-80   .6515   200-120 -9.8670    500-200  2.9136   80M
     CH   49-51     120-80   .6778   200-120-10.4684    500-200  3.0906   85M
     CH   52-54     120-80   .7176   200-120-11.0913    500-200  3.2640   90M
     CH   55-57     120-80   .7520   200-120-11.7079    500-200  3.4378   95M
     CH   58-60     120-80   .7909   200-120-12.3232    500-200  3.6113  100M
     CH   61-63     120-80   .8403   200-120-12.9473    500-200  3.7825  105M
     CH   64-66     120-80   .8810   200-120-13.5528    500-200  3.9554  110M
     CH   67-69     120-80   .9039   200-120-14.1330    500-200  4.1303  115M
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1972 AUG STATION 12 DEPTH 21 METERS PREAMP 10**4 AVE 5 DEPTH 25
     MEAN VALUE OF PRØFILES ØVER 5M INTERVALS

     CH    1-21      120-80    .0971   200-120  1.6866   500-200    .1297   5M
     CH   22-42      120-80  -.5097    200-120  2.0719   500-200    .2317  10M
     CH   43-63      120-80  -.5147    200-120  1.5431   500-200    .4288  15M
     CH   64-84      120-80 -1.0890    200-120  1.5037   500-200    .6381  20M
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1972 AUG STATION 14 DEPTH 10 METERS PREAMP 10**4 AVE 5 DEPTH 17
     MEAN VALUE OF PRØFILES ØVER 5M INTERVALS

     CH    1-29      120-80    .1007   200-120   .5496   500-200    .0681   5M
     CH   30-58      120-80    .3652   200-120   .3997   500-200    .2605  10M
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1972
     AUG STATION 15 DEPTH 102 METERS PREAMP 10**4 AVE 5 DEPTH 140
     MEAN VALUE OF PRØFILES ØVER 5M INTERVALS

     CH    1- 3      120-80  -.5227    200-120   .0542   500-200    .1461    5M
     CH    4- 6      120-80 -1.0174    200-120   .2679   500-200    .2654   10M
     CH    7- 9      120-80 -1.8632    200-120   .4646   500-200    .3591   15M
     CH   10-12      120-80 -1.9734    200-120   .6575   500-200    .4875   20M
     CH   13-15      120-80 -1.9819    200-120   .8414   500-200    .6556   25M
     CH   16-18      120-80 -1.9782    200-120  1.0188   500-200    .8049   30M
     CH   19-21      120-80 -1.9782    200-120  1.1820   500-200    .9541   35M
     CH   22-24      120-80 -1.9940    200-120  1.3504   500-200   1.0749   40M
     CH   25-27      120-80 -2.0053    200-120  1.6240   500-200   1.1788   45M
     CH   28-30      120-80 -2.0046    200-120  1.8221   500-200   1.2794   50M
     CH   31-33      120-80 -1.9826    200-120  1.9766   500-200   1.3796   55M
     CH   34-36      120-80 -1.9415    200-120  2.0862   500-200   1.4772   60M
     CH   37-39      120-80 -1.8873    200-120  2.1743   500-200   1.5763   65M
     CH   40-42      120-80 -1.8558    200-120  2.2661   500-200   1.6724   70M
     CH   43-45      120-80 -1.8505    200-120  2.3579   500-200   1.7689   75M
     CH   46-48      120-80 -1.8423    200-120  2.4819   500-200   1.8675   80M
     CH   49-51      120-80 -1.8376    200-120  2.6134   500-200   1.9658   85M
     CH   52-54      120-80 -1.8320    200-120  2.7465   500-200   2.0644   90M
     CH   55-57      120-80 -1.8320    200-120  2.8746   500-200   2.1592   95M
     CH   58-60      120-80 -1.8261    200-120  3.0015   500-200   2.2563  100M
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1972 AUG STA 17 PA 10**4 AVG 5 DEPTH 130 SCAN 170
     MEAN VALUE ØF PROFILES ØVER 5M INTERVALS

     CH    1- 2     120-80   .9935   200-120   .0049    500-200  -.2037    5M
     CH    3- 4     120-80  1.1239   200-120   .1957    500-200  -.0080   10M
     CH    5- 6     120-80  1.1377   200-120   .3986    500-200   .2051   15M
     CH    7- 8     120-80  1.1366   200-120   .6037    500-200   .4377   20M
     CH    9-10     120-80  1.1342   200-120   .7978    500-200   .6777   25M
     CH   11-12     120-80  1.1323   200-120   .9785    500-200   .9234   30M
     CH   13-14     120-80  1.1280   200-120  1.1488    500-200  1.1705   35M
     CH   15-16     120-80  1.1386   200-120  1.3070    500-200  1.4005   40M
     CH   17-18     120-80  1.1427   200-120  1.4571    500-200  1.6077   45M
     CH   19-20     120-80  1.1404   200-120  1.6107    500-200  1.8076   50M
     CH   21-22     120-80  1.1349   200-120  1.7568    500-200  2.0022   55M
     CH   23-24     120-80  1.1282   200-120  1.9023    500-200  2.1948   60M
     CH   25-26     120-80  1.1211   200-120  2.0514    500-200  2.3868   65M
     CH   27-28     120-80  1.1169   200-120  2.1974    500-200  2.5767   70M
     CH   29-30     120-80  1.1171   200-120  2.3510    500-200  2.7693   75M
     CH   31-32     120-80  1.1127   200-120  2.5225    500-200  2.9625   80M
     CH   33-34     120-80  1.1095   200-120  2.7041    500-200  3.1535   85M
     CH   35-36     120-80  1.0990   200-120  2.8938    500-200  3.3458   90M
     CH   37-38     120-80  1.0896   200-120  3.0868    500-200  3.5380   95M
     CH   39-40     120-80  1.0839   200-120  3.2811    500-200  3.7301  100M
     CH   41-42     120-80  1.0806   200-120  3.4745    500-200  3.9177  105M
     CH   43-44     120-80  1.0687   200-120  3.6694    500-200  4.1074  110M
     CH   45-46     120-80  1.0637   200-120  3.8676    500-200  4.2989  115M
     CH   47-48     120-80  1.0589   200-120  4.0642    500-200  4.4900  120M
     CH   49-50     120-80  1.0518   200-120  4.2613    500-200  4.6790  125M
     CH   51-52     120-80  1.0486   200-120  4.4559    500-200  4.8666  130M
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1972 AUG STATION 19 DEPTH 14 METERS PREAMP 10**4 AVE 5 DEPTH 25
     MEAN VALUE ØF PRØFILES ØVER 5M INTERVALS

     CH    1-28     120-80  1.2320   200-120   .4721    500-200   .2866    5M
     CH   29-56     120-80   .9767   200-120  -.3538    500-200   .4744   10M
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1972 AUG STATIØN 20 DEPTH 18 PA 10**4 AVG 5 DEPTH 31
     MEAN VALUE ØF PROFILES ØVER 5M INTERVALS

     CH    1-19     120-80   .4778   200-120 -1.5842    500-200   .2711    5M
     CH   20-38     120-80   .6679   200-120  -.8995    500-200   .5612   10M
     CH   39-57     120-80   .7308   200-120  -.7441    500-200   .8779   15M
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1972 AUG STATION 24 DEPTH 114 METERS PREAMP 10**4 DEPTPH 150
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 3     120-80  -.4321    200-120    .0066    500-200    .2815    5M
     CH    4- 6     120-80  -.8316    200-120    .0065    500-200    .4127   10M
     CH    7- 9     120-80 -1.1702    200-120    .0033    500-200    .5139   15M
     CH   10-12     120-80 -1.4915    200-120   -.0071    500-200    .6181   20M
     CH   13-15     120-80 -1.7986    200-120   -.0045    500-200    .7270   25M
     CH   16-18     120-80 -2.0931    200-120   -.0068    500-200    .8273   30M
     CH   19-21     120-80 -2.3922    200-120   -.0177    500-200    .9320   35M
     CH   22-24     120-80 -2.6911    200-120   -.0205    500-200   1.0356   40M
     CH   25-27     120-80 -2.9874    200-120   -.0281    500-200   1.1363   45M
     CH   28-30     120-80 -3.2784    200-120   -.0266    500-200   1.2445   50M
     CH   31-33     120-80 -3.5677    200-120   -.0310    500-200   1.3494   55M
     CH   34-36     120-80 -3.8623    200-120   -.0408    500-200   1.4528   60M
     CH   37-39     120-80 -4.1684    200-120   -.0354    500-200   1.5624   65M
     CH   40-42     120-80 -4.4585    200-120   -.0459    500-200   1.6651   70M
     CH   43-45     120-80 -4.7553    200-120   -.0410    500-200   1.7717   75M
     CH   46-48     120-80 -5.0507    200-120   -.0440    500-200   1.8754   80M
     CH   49-51     120-80 -5.3399    200-120   -.0551    500-200   1.9802   85M
     CH   52-54     120-80 -5.6402    200-120   -.0534    500-200   2.0943   90M
     CH   55-57     120-80 -5.9366    200-120   -.0567    500-200   2.2031   95M
     CH   58-60     120-80 -6.2276    200-120   -.0571    500-200   2.3211  100M
     CH   61-63     120-80 -6.5223    200-120   -.0625    500-200   2.4368  105M
     CH   64-66     120-80 -6.8180    200-120   -.0733    500-200   2.5467  110M

1972 AUG STATION 26  DEPTH 146 METERS PRE 10**4 AVE 5 DEPTH  200
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2     120-80   .8427    200-120   -.4925    500-200    .1155    5M
     CH    3- 4     120-80   .6408    200-120   -.5509    500-200    .3108   10M
     CH    5- 6     120-80   .6363    200-120   -.5153    500-200    .5065   15M
     CH    7- 8     120-80   .6232    200-120   -.4598    500-200    .6989   20M
     CH    9-10     120-80   .6187    200-120   -.3976    500-200    .8899   25M
     CH   11-12     120-80   .6914    200-120   -.3774    500-200   1.0771   30M
     CH   13-14     120-80   .7840    200-120   -.3585    500-200   1.2680   35M
     CH   15-16     120-80   .8582    200-120   -.3143    500-200   1.4544   40M
     CH   17-18     120-80   .9237    200-120   -.2685    500-200   1.6378   45M
     CH   19-20     120-80   .9583    200-120   -.2274    500-200   1.8231   50M
     CH   21-22     120-80   .9975    200-120   -.1813    500-200   2.0090   55M
     CH   23-24     120-80  1.0322    200-120   -.1280    500-200   2.1914   60M
     CH   25-26     120-80  1.0720    200-120   -.0833    500-200   2.3765   65M
     CH   27-28     120-80  1.0997    200-120   -.0388    500-200   2.5560   70M
     CH   29-30     120-80  1.1328    200-120    .0019    500-200   2.7358   75M
     CH   31-32     120-80  1.1622    200-120    .0431    500-200   2.9144   80M
     CH   33-34     120-80  1.1907    200-120    .0862    500-200   3.0979   85M
     CH   35-36     120-80  1.2345    200-120    .1270    500-200   3.2834   90M
     CH   37-38     120-80  1.2617    200-120    .1676    500-200   3.4689   95M
     CH   39-40     120-80  1.2968    200-120    .2117    500-200   3.6536  100M
     CH   41-42     120-80  1.3461    200-120    .2563    500-200   3.8386  105M
     CH   43-44     120-80  1.3817    200-120    .2965    500-200   4.0287  110M
     CH   45-46     120-80  1.4039    200-120    .3489    500-200   4.2177  115M
     CH   47-48     120-80  1.4317    200-120    .3988    500-200   4.4073  120M
     CH   49-50     120-80  1.4645    200-120    .4395    500-200   4.5970  125M
     CH   51-52     120-80  1.4961    200-120    .4841    500-200   4.7880  130M
     CH   53-54     120-80  1.5336    200-120    .5281    500-200   4.9801  135M
     CH   55-56     120-80  1.5757    200-120    .5741    500-200   5.1733  140M
     CH   57-58     120-80  1.6138    200-120    .6233    500-200   5.3676  145M
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1972 AUG STATION 30 DEPTH 20 PRF 10**4 AVE 5 DEPTH 50
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-10      120-80   .5450   200-120   .6210    500-200   .0882    5M
     CH  11-20      120-80   .8197   200-120  1.8323    500-200   .6114   10M
     CH  21-30      120-80  1.9730   200-120  2.2402    500-200  1.1592   15M
     CH  31-40      120-80  2.6396   200-120  3.1504    500-200  1.6984   20M
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1972 AUG STATION 31 DEPTH 28 METERS PRF 10**4 AVE 5 DEPTH 45
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-12      120-80  1.1642   200-120  2.4777    500-200  -.6082    5M
     CH  13-24      120-80  1.4776   200-120  6.4325    500-200  -.8262   10M
     CH  25-36      120-80  1.3738   200-120 11.0377    500-200  -.8072   15M
     CH  37-48      120-80  3.2533   200-120 13.7034    500-200  -.7972   20M
     CH  49-60      120-80  5.1432   200-120 15.8231    500-200  -.7876   25M
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1972 AUG STATION 32 DEPTH 171 METERS  PRE 10**4 AV3 5 DEPTH 250
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 2      120-80   .0424   200-120   .3145    500-200   .1344    5M
     CH   3- 4      120-80   .0329   200-120   .5100    500-200   .3412   10M
     CH   5- 6      120-80   .0242   200-120   .6792    500-200   .5704   15M
     CH   7- 8      120-80   .0254   200-120   .8182    500-200   .8048   20M
     CH   9-10      120-80   .0176   200-120   .9472    500-200  1.0072   25M
     CH  11-12      120-80   .0122   200-120  1.0671    500-200  1.1884   30M
     CH  13-14      120-80   .0076   200-120  1.1812    500-200  1.3624   35M
     CH  15-16      120-80   .0031   200-120  1.2955    500-200  1.5345   40M
     CH  17-18      120-80  -.0036   200-120  1.4347    500-200  1.7032   45M
     CH  19-20      120-80  -.0116   200-120  1.5885    500-200  1.8729   50M
     CH  21-22      120-80  -.0220   200-120  1.7552    500-200  2.0423   55M
     CH  23-24      120-80  -.0292   200-120  1.9242    500-200  2.2119   60M
     CH  25-26      120-80  -.0383   200-120  2.0986    500-200  2.3803   65M
     CH  27-28      120-80  -.0388   200-120  2.2726    500-200  2.5485   70M
     CH  29-30      120-80  -.0441   200-120  2.4442    500-200  2.7156   75M
     CH  31-32      120-80  -.0508   200-120  2.6203    500-200  2.8842   80M
     CH  33-34      120-80  -.0583   200-120  2.7933    500-200  3.0527   85M
     CH  35-36      120-80  -.0627   200-120  2.9654    500-200  3.2184   90M
     CH  37-38      120-80  -.0729   200-120  3.1407    500-200  3.3859   95M
     CH  39-40      120-80  -.0916   200-120  3.3163    500-200  3.5544  100M
     CH  41-42      120-80  -.1046   200-120  3.4932    500-200  3.7229  105M
     CH  43-44      120-80  -.1072   200-120  3.6628    500-200  3.8892  110M
     CH  45-46      120-80  -.1222   200-120  3.8365    500-200  4.0566  115M
     CH  47-48      120-80  -.1345   200-120  4.0095    500-200  4.2237  120M
     CH  49-50      120-80  -.1545   200-120  4.1844    500-200  4.3928  125M
     CH  51-52      120-80  -.1630   200-120  4.3572    500-200  4.5597  130M
     CH  53-54      120-80  -.1682   200-120  4.5329    500-200  4.7267  135M
     CH  55-56      120-80  -.1766   200-120  4.7067    500-200  4.8937  140M
     CH  57-58      120-80  -.1836   200-120  4.8841    500-200  5.0623  145M
     CH  59-60      120-80  -.1972   200-120  5.0608    500-200  5.2320  150M
     CH  61-62      120-80  -.2160   200-120  5.2334    500-200  5.3991  155M
     CH  63-64      120-80  -.2248   200-120  5.4060    500-200  5.5680  160M
     CH  65-66      120-80  -.2310   200-120  5.5758    500-200  5.7369  165M
     CH  67-68      120-80  -.2382   200-120  5.7413    500-200  5.9037  170M
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1972 AUG STATION 34 DEPTH 85 M PA 10**4 AVG 5 DEPTH 150 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 3      120-80   -.1097    200-120   -.3552    500-200   -.0045    5M
     CH    4- 6      120-80   -.3403    200-120   -.2320    500-200    .0524   10M
     CH    7- 9      120-80   -.4103    200-120   -.0387    500-200    .1140   15M
     CH   10-12      120-80   -.4469    200-120    .1495    500-200    .1643   20M
     CH   13-15      120-80   -.4720    200-120    .3239    500-200    .2153   25M
     CH   16-18      120-80   -.4962    200-120    .5007    500-200    .2624   30M
     CH   19-21      120-80   -.5129    200-120    .6820    500-200    .3074   35M
     CH   22-24      120-80   -.5434    200-120    .8689    500-200    .3526   40M
     CH   25-27      120-80   -.5719    200-120   1.0500    500-200    .4002   45M
     CH   28-30      120-80   -.5948    200-120   1.2237    500-200    .4473   50M
     CH   31-33      120-80   -.6266    200-120   1.4017    500-200    .4917   55M
     CH   34-36      120-80   -.6650    200-120   1.5862    500-200    .5351   60M
     CH   37-39      120-80   -.7031    200-120   1.7659    500-200    .5816   65M
     CH   40-42      120-80   -.7352    200-120   1.9466    500-200    .6246   70M
     CH   43-45      120-80   -.7584    200-120   2.1221    500-200    .6692   75M
     CH   46-48      120-80   -.7818    200-120   2.2995    500-200    .7108   80M
     CH   49-51      120-80   -.8093    200-120   2.4758    500-200    .7547   85M
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1972 AUG STATION 35  DEPTH 29 METERS  PRE 10**4  AVE 5  DEPTH 35
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-16      120-80    .6218    200-120    .6437    500-200   -.3281    5M
     CH   17-32.     120-80   1.0086    200-120   1.2381    500-200   -.1735   10M
     CH   33-48      120-80   1.2079    200-120   1.6278    500-200    .0110   15M
     CH   49-64      120-80   1.2170    200-120   4.3624    500-200    .2065   20M
     CH   65-80      120-80   1.2077    200-120   [illegible].1681    500-200    .4085   25M
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1972 AUG STATION 36 DEPTH 30 METERS PREAMP 10**4 AVE 55 DEPTH 35
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-14      120-80   -.1437    200-120    .7650    500-200   -.1621    5M
     CH   15-28      120-80   -.0319    200-120   1.2734    500-200    .1898   10M
     CH   29-42      120-80   -.3958    200-120   2.2566    500-200    .5522   15M
     CH   43-56      120-80   -.8767    200-120   3.3557    500-200    .9215   20M
     CH   57-70      120-80  -1.0429    200-120   4.1117    500-200   1.2887   25M
     CH   71-84      120-80   -.8993    200-120   3.7747    500-200   1.6411   30M
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1972 AUG STATION 38 DEPTH 125 METERS AVE 5 PRE 10**4 DEPTH 145
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 3     120-80   .5018   200-120    .2373   500-200    .2122    5M
     CH    4- 6     120-80  -.1410   200-120    .8072   500-200    .4416   10M
     CH    7- 9     120-80  -.1561   200-120    .5588   500-200    .7191   15M
     CH   10-12     120-80   .1971   200-120    .3782   500-200   1.0368   20M
     CH   13-15     120-80   .3645   200-120    .5391   500-200   1.3674   25M
     CH   16-18     120-80   .7728   200-120    .4242   500-200   1.6967   30M
     CH   19-21     120-80  1.0756   200-120    .3730   500-200   1.9927   35M
     CH   22-24     120-80  1.1440   200-120    .5520   500-200   2.2770   40M
     CH   25-27     120-80  1.2227   200-120    .7029   500-200   2.5570   45M
     CH   28-30     120-80  1.3216   200-120    .8273   500-200   2.8355   50M
     CH   31-33     120-80  1.3361   200-120   1.0394   500-200   3.1138   55M
     CH   34-36     120-80  1.3089   200-120   1.2224   500-200   3.3918   60M
     CH   37-39     120-80  1.3014   200-120   1.4048   500-200   3.6697   65M
     CH   40-42     120-80  1.3204   200-120   1.5882   500-200   3.9471   70M
     CH   43-45     120-80  1.3158   200-120   1.7722   500-200   4.2242   75M
     CH   46-48     120-80  1.3206   200-120   1.9516   500-200   4.5030   80M
     CH   49-51     120-80  1.3372   200-120   2.1395   500-200   4.7802   85M
     CH   52-54     120-80  1.3202   200-120   2.3525   500-200   5.0598   90M
     CH   55-57     120-80  1.4819   200-120   2.4030   500-200   5.3349   95M
     CH   58-60     120-80  1.5665   200-120   2.5473   500-200   5.6111  100M
     CH   61-63     120-80  1.5885   200-120   2.7592   500-200   5.8871  105M
     CH   64-66     120-80  1.6004   200-120   2.9861   500-200   6.1630  110M
     CH   67-69     120-80  1.6069   200-120   3.2215   500-200   6.4393  115M
     CH   70-72     120-80  1.6178   200-120   3.4536   500-200   6.7147  120M
     CH   73-75     120-80  1.6350   200-120   3.6857   500-200   6.9930  125M
1972
     AUG STATION 40 DEPTH 175 METERS PRE 10 **4 AVE 5 DEPTH 250
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2     120-80   .2274   200-120    .6029   500-200   -.2473    5M
     CH    3- 4     120-80   .2606   200-120    .8427   500-200   -.1545   10M
     CH    5- 6     120-80   .2664   200-120   1.0325   500-200   -.0385   15M
     CH    7- 8     120-80   .2718   200-120   1.2035   500-200    .0827   20M
     CH    9-10     120-80   .2779   200-120   1.3541   500-200    .1895   25M
     CH   11-12     120-80   .2829   200-120   1.4982   500-200    .2658   30M
     CH   13-14     120-80   .2837   200-120   1.6472   500-200    .3318   35M
     CH   15-16     120-80   .2851   200-120   1.7904   500-200    .3955   40M
     CH   17-18     120-80   .2847   200-120   1.9367   500-200    .4556   45M
     CH   19-20     120-80   .2888   200-120   2.0998   500-200    .5141   50M
     CH   21-22     120-80   .2948   200-120   2.2747   500-200    .5735   55M
     CH   23-24     120-80   .2946   200-120   2.4634   500-200    .6322   60M
     CH   25-26     120-80   .2931   200-120   2.6535   500-200    .6911   65M
     CH   27-28     120-80   .2883   200-120   2.8441   500-200    .7482   70M
     CH   29-30     120-80   .2910   200-120   3.0400   500-200    .8044   75M
     CH   31-32     120-80   .2868   200-120   3.2290   500-200    .8597   80M
     CH   33-34     120-80   .2803   200-120   3.4249   500-200    .9150   85M
     CH   35-36     120-80   .2789   200-120   3.6205   500-200    .9695   90M
     CH   37-38     120-80   .2672   200-120   3.8189   500-200   1.0249   95M
     CH   39-40     120-80   .2689   200-120   4.0143   500-200   1.0794  100M
     CH   41-42     120-80   .2679   200-120   4.2120   500-200   1.1320  105M
     CH   43-44     120-80   .2639   200-120   4.4076   500-200   1.1852  110M
     CH   45-46     120-80   .2611   200-120   4.6027   500-200   1.2413  115M
     CH   47-48     120-80   .2610   200-120   4.7963   500-200   1.2959  120M
     CH   49-50     120-80   .2627   200-120   4.9884   500-200   1.3482  125M
     CH   51-52     120-80   .2609   200-120   5.1826   500-200   1.4014  130M
     CH   53-54     120-80   .2596   200-120   5.3792   500-200   1.4542  135M
     CH   55-56     120-80   .2490   200-120   5.5744   500-200   1.5084  140M
     CH   57-58     120-80   .2420   200-120   5.7725   500-200   1.5603  145M
     CH   59-60     120-80   .2444   200-120   5.9643   500-200   1.6127  150M
     CH   61-62     120-80   .2379   200-120   6.1638   500-200   1.6656  155M
     CH   63-64     120-80   .2387   200-120   6.3570   500-200   1.7195  160M
     CH   65-66     120-80   .2366   200-120   6.5526   500-200   1.7721  165M
     CH   67-68     120-80   .2315   200-120   6.7451   500-200   1.8242  170M
     CH   69-70     120-80   .2270   200-120   6.9406   500-200   1.8792  175M
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1972 AUG STATION 41 DEPTH 26 METERS AVE 5 PREAMP 10**4 DEPTH 40
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-13      120-80   .1004   200-120  -.7465   500-200   .4527   5M
     CH  14-26      120-80  -.3110   200-120  -.7353   500-200   .8795  10M
     CH  27-39      120-80  -.6649   200-120  -.6441   500-200  1.3055  15M
     CH  40-52      120-80  -.7378   200-120  -.5264   500-200  1.7299  20M
     CH  53-65      120-80  -.6396   200-120  -.4435   500-200  1.8984  25M
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1972 AUG STATION 42 DEPTH 15 METERSO  PRREAMP 10**4 AVE 5 DEPTH
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-16      120-80   .0990   200-120  1.3608   500-200   .3011   5M
     CH  17-32      120-80   .1979   200-120   .6838   500-200   .4869  10M
     CH  33-48      120-80   .0044   200-120   .0444   500-200   .6918  15M
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1972 AUG STATION 44 DEPTH  174  PREAMP 10**4  DEPTH  200 METERS
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 2      120-80   .8706   200-120  -.3853   500-200   .2688   5M
     CH   3- 4      120-80  1.2459   200-120  -.5380   500-200   .1853  10M
     CH   5- 6      120-80  1.3563   200-120   .1219   500-200   .4945  15M
     CH   7- 8      120-80  1.4180   200-120   .6090   500-200   .9272  20M
     CH   9-10      120-80  1.7678   200-120   .6527   500-200  1.3656  25M
     CH  11-12      120-80  1.9710   200-120   .6555   500-200  1.7925  30M
     CH  13-14      120-80  2.0850   200-120   .7194   500-200  2.1988  35M
     CH  15-16      120-80  2.1324   200-120   .8388   500-200  2.5988  40M
     CH  17-18      120-80  2.1682   200-120   .9667   500-200  2.9948  45M
     CH  19-20      120-80  2.2081   200-120  1.0894   500-200  3.3889  50M
     CH  21-22      120-80  2.2409   200-120  1.2190   500-200  3.7807  55M
     CH  23-24      120-80  2.2678   200-120  1.3629   500-200  4.1743  60M
     CH  25-26      120-80  2.2953   200-120  1.5175   500-200  4.5670  65M
     CH  27-28      120-80  2.3339   200-120  1.6743   500-200  4.9580  70M
     CH  29-30      120-80  2.3733   200-120  1.8337   500-200  5.3505  75M
     CH  31-32      120-80  2.4027   200-120  2.0006   500-200  5.7426  80M
     CH  33-34      120-80  2.4246   200-120  2.1713   500-200  6.1358  85M
     CH  35-36      120-80  2.4405   200-120  2.3405   500-200  6.5294  90M
     CH  37-38      120-80  2.4718   200-120  2.5162   500-200  6.9221  95M
     CH  39-40      120-80  2.5100   200-120  2.6785   500-200  7.3157 100M
     CH  41-42      120-80  2.5371   200-120  2.8429   500-200  7.7076 105M
     CH  43-44      120-80  2.5659   200-120  3.0080   500-200  8.1009 110M
     CH  45-46      120-80  2.5943   200-120  3.1744   500-200  8.4930 115M
     CH  47-48      120-80  2.6209   200-120  3.3421   500-200  8.8865 120M
     CH  49-50      120-80  2.6500   200-120  3.5105   500-200  9.2790 125M
     CH  51-52      120-80  2.6786   200-120  3.6777   500-200  9.6717 130M
     CH  53-54      120-80  2.7090   200-120  3.8468   500-200 10.0644 135M
     CH  55-56      120-80  2.7366   200-120  4.0165   500-200 10.4553 140M
     CH  57-58      120-80  2.7618   200-120  4.1846   500-200 10.8489 145M
     CH  59-60      120-80  2.7901   200-120  4.3479   500-200 11.2401 150M
     CH  61-62      120-80  2.8162   200-120  4.5141   500-200 11.6351 155M
     CH  63-64      120-80  2.8477   200-120  4.6819   500-200 12.0277 160M
     CH  65-66      120-80  2.8721   200-120  4.8504   500-200 12.4200 165M
     CH  67-68      120-80  2.9014   200-120  5.0156   500-200 12.8146 170M
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1972 AUG STATION 45 DEPTH 200 METERS PREAMP 10**4 AVE 5 DEPTH 220
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2      120-80    .0876   200-120    .4578    500-200  -.6339    5M
     CH    3- 4      120-80    .2836   200-120   1.0111    500-200  -.4951   10M
     CH    5- 6      120-80  -.4215    200-120   1.4129    500-200  -.1980   15M
     CH    7- 8      120-80  -.4959    200-120   1.6151    500-200   .1067   20M
     CH    9-10      120-80  -.4790    200-120   1.7748    500-200   .3978   25M
     CH   11-12      120-80  -.4539    200-120   1.9233    500-200   .6628   30M
     CH   13-14      120-80  -.4314    200-120   2.0691    500-200   .9211   35M
     CH   15-16      120-80  -.4060    200-120   2.2124    500-200  1.1713   40M
     CH   17-18      120-80  -.3837    200-120   2.3583    500-200  1.4191   45M
     CH   19-20      120-80  -.3644    200-120   2.5246    500-200  1.6695   50M
     CH   21-22      120-80  -.3475    200-120   2.7006    500-200  1.9178   55M
     CH   23-24      120-80  -.3328    200-120   2.8830    500-200  2.1657   60M
     CH   25-26      120-80  -.3236    200-120   3.0698    500-200  2.4129   65M
     CH   27-28      120-80  -.3059    200-120   3.2568    500-200  2.6584   70M
     CH   29-30      120-80  -.2863    200-120   3.4441    500-200  2.9064   75M
     CH   31-32      120-80  -.2686    200-120   3.6320    500-200  3.1510   80M
     CH   33-34      120-80  -.2504    200-120   3.8209    500-200  3.3976   85M
     CH   35-36      120-80  -.2229    200-120   4.0101    500-200  3.6453   90M
     CH   37-38      120-80  -.1942    200-120   4.1965    500-200  3.8904   95M
     CH   39-40      120-80  -.1769    200-120   4.3861    500-200  4.1358  100M
     CH   41-42      120-80  -.1687    200-120   4.5788    500-200  4.3830  105M
     CH   43-44      120-80  -.1495    200-120   4.7686    500-200  4.6281  110M
     CH   45-46      120-80  -.1233    200-120   4.9547    500-200  4.8746  115M
     CH   47-48      120-80  -.1077    200-120   5.1455    500-200  5.1185  120M
     CH   49-50      120-80  -.0892    200-120   5.3283    500-200  5.3648  125M
     CH   51-52      120-80  -.0715    200-120   5.5132    500-200  5.6101  130M
     CH   53-54      120-80  -.0521    200-120   5.6983    500-200  5.8526  135M
     CH   55-56      120-80  -.0430    200-120   5.8863    500-200  6.0973  140M
     CH   57-58      120-80  -.0298    200-120   6.0726    500-200  6.3415  145M
     CH   59-60      120-80  -.0111    200-120   6.2597    500-200  6.5871  150M
     CH   61-62      120-80    .0021   200-120   6.4468    500-200  6.8288  155M
     CH   63-64      120-80    .0186   200-120   6.6328    500-200  7.0732  160M
     CH   65-66      120-80    .0381   200-120   6.8189    500-200  7.3173  165M
     CH   67-68      120-80    .0547   200-120   7.0012    500-200  7.5604  170M
     CH   69-70      120-80    .0656   200-120   7.1874    500-200  7.8071  175M
     CH   71-72      120-80    .0794   200-120   7.3733    500-200  8.0533  180M
     CH   73-74      120-80    .0913   200-120   7.5628    500-200  8.2976  185M
     CH   75-76      120-80    .1122   200-120   7.7484    500-200  8.5416  190M
     CH   77-78      120-80    .1203   200-120   7.9385    500-200  8.7875  195M
     CH   79-80      120-80    .1420   200-120   8.1172    500-200  9.0277  200M
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1972 AUG STATION 46 DEPTH 120 METERS PREAMP 10**4 AVES DEPTH 150
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 3      120-80    .1903   200-120  2.1824    500-200 -1.3690   5M
     CH    4- 6      120-80    .6815   200-120  2.7653    500-200 -1.6090  10M
     CH    7- 9      120-80   1.1051   200-120  3.3084    500-200 -1.6026  15M
     CH   10-12      120-80   1.2764   200-120  3.7686    500-200 -1.5976  20M
     CH   13-15      120-80   1.4685   200-120  3.7109    500-200 -1.5843  25M
     CH   16-18      120-80   1.5042   200-120  3.7329    500-200 -1.5920  30M
     CH   19-21      120-80   1.5158   200-120  3.7431    500-200 -1.6158  35M
     CH   22-24      120-80   1.5322   200-120  3.7317    500-200 -1.6460  40M
     CH   25-27      120-80   1.5511   200-120  3.7170    500-200 -1.6818  45M
     CH   28-30      120-80   1.5670   200-120  3.7138    500-200 -1.7193  50M
     CH   31-33      120-80   1.5763   200-120  3.7088    500-200 -1.7579  55M
     CH   34-36      120-80   1.5833   200-120  3.6966    500-200 -1.7983  60M
     CH   37-39      120-80   1.5860   200-120  3.6871    500-200 -1.8404  65M
     CH   40-42      120-80   1.5882   200-120  3.6727    500-200 -1.8706  70M
     CH   43-45      120-80   1.5942   200-120  3.6622    500-200 -1.9198  75M
     CH   46-48      120-80   1.6039   200-120  3.6632    500-200 -1.9594  80M
     CH   49-51      120-80   1.6034   200-120  3.6716    500-200 -1.9960  85M
     CH   52-54      120-80   1.5971   200-120  3.6687    500-200 -2.0386  90M
     CH   55-57      120-80   1.5942   200-120  3.7085    500-200 -2.0811  95M
     CH   58-60      120-80   1.5916   200-120  3.7358    500-200 -2.1247 100M
     CH   61-63      120-80   1.5924   200-120  3.7655    500-200 -2.1654 105M
     CH   64-66      120-80   1.5902   200-120  3.8021    500-200 -2.2065 110M
     CH   67-69      120-80   1.5798   200-120  3.8386    500-200 -2.2460 115M
     CH   70-72      120-80   1.5736   200-120  3.8790    500-200 -2.2840 120M
1972
     AUG STATION 48 DEPTH 26 PREAMP 10**4 AVE 5 DEPTH 35
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-14      120-80    .7803   200-120   .6004    500-200  -.3011   5M
     CH   15-28      120-80    .6181   200-120  1.8190    500-200  -.3170  10M
     CH   29-42      120-80    .5725   200-120  2.1448    500-200  -.3083  15M
     CH   43-56      120-80    .5984   200-120  2.1082    500-200  -.2894  20M
     CH   57-70      120-80    .6273   200-120  1.9898    500-200  -.2676  25M


1972 AUG STATION 49 DEPTH 20  DEPTH 25 METERS AVE 5 PREAMP 10**4
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-20      120-80  -.8125   200-120   .0037    500-200   .1876   5M
     CH   21-40      120-80 -1.5937   200-120  -.1135    500-200   .3831  10M
     CH   41-60      120-80 -2.3075   200-120  -.2169    500-200   .5783  15M
     CH   61-80      120-80 -2.9413   200-120  -.3028    500-200   .7734  20M
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1972 AUG STATION 52 DEPTH 100 DEPTH 65 PA 10/4 AVE 5
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 5     120-80   .0939   200-120  -.2483    500-200  -.0787   5M
     CH   6-10     120-80   .6248   200-120  -.9743    500-200   .0898  10M
     CH  11-15     120-80   .2512   200-120 -1.0091    500-200   .2550  15M
     CH  16-20     120-80  -.4655   200-120  -.9671    500-200   .4225  20M
     CH  21-25     120-80 -1.0870   200-120  -.9341    500-200   .6143  25M
     CH  26-30     120-80 -1.0277   200-120  -.8664    500-200   .8307  30M
     CH  31-35     120-80 -2.2190   200-120  -.8103    500-200  1.0517  35M
     CH  36-40     120-80 -2.9990   200-120  -.7717    500-200  1.2696  40M
     CH  41-45     120-80 -3.4892   200-120  -.7387    500-200  1.4920  45M
     CH  46-50     120-80 -3.7771   200-120  -.6998    500-200  1.7139  50M
     CH  51-55     120-80 -3.9503   200-120  -.6492    500-200  1.9381  55M
     CH  56-60     120-80 -4.0104   200-120  -.5935    500-200  2.1616  60M
     CH  61-65     120-80 -4.0301   200-120  -.5268    500-200  2.3849  65M
1972
     AUG STATION 54   DEPTH 180 DEPTH 139 PA 10/4 AVEES
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 2     120-80   .2321   200-120  1.9078    500-200  -.9021    5M
     CH   3- 4     120-80   .2747   200-120  2.2473    500-200  -.7665   10M
     CH   5- 6     120-80   .2934   200-120  2.3455    500-200  -.6143   15M
     CH   7- 8     120-80   .3128   200-120  2.4114    500-200  -.4693   20M
     CH   9-10     120-80   .3306   200-120  2.4702    500-200  -.3161   25M
     CH  11-12     120-80   .3449   200-120  2.5272    500-200  -.1676   30M
     CH  13-14     120-80   .3609   200-120  2.5853    500-200  -.0151   35M
     CH  15-16     120-80   .3727   200-120  2.6462    500-200   .1379   40M
     CH  17-18     120-80   .3839   200-120  2.7062    500-200   .2867   45M
     CH  19-20     120-80   .3966   200-120  2.7565    500-200   .4425   50M
     CH  21-22     120-80   .4097   200-120  2.8096    500-200   .5861   55M
     CH  23-24     120-80   .4240   200-120  2.8598    500-200   .7403   60M
     CH  25-26     120-80   .4347   200-120  2.9121    500-200   .8979   65M
     CH  27-28     120-80   .4469   200-120  2.9621    500-200  1.0537   70M
     CH  29-30     120-80   .4582   200-120  3.0126    500-200  1.2116   75M
     CH  31-32     120-80   .4717   200-120  3.0630    500-200  1.3649   80M
     CH  33-34     120-80   .4833   200-120  3.1143    500-200  1.5279   85M
     CH  35-36     120-80   .4950   200-120  3.1674    500-200  1.6876   90M
     CH  37-38     120-80   .5054   200-120  3.2159    500-200  1.8497   95M
     CH  39-40     120-80   .5170   200-120  3.2646    500-200  2.0171  100M
     CH  41-42     120-80   .5256   200-120  3.3195    500-200  2.1842  105M
     CH  43-44     120-80   .5353   200-120  3.3728    500-200  2.3464  110M
     CH  45-46     120-80   .5459   200-120  3.4204    500-200  2.5203  115M
     CH  47-48     120-80   .5560   200-120  3.4702    500-200  2.6844  120M
     CH  49-50     120-80   .5619   200-120  3.5206    500-200  2.8502  125M
     CH  51-52     120-80   .5716   200-120  3.5691    500-200  3.0208  130M
     CH  53-54     120-80   .5810   200-120  3.6171    500-200  3.1883  135M

1972 AUG STATION 59  DEPTH 35 DEPTH 26 80 KC PA LO // 4  AVE 5
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-14     120-80  1.2366   200-120 -1.1462    500-200   .1692    5M
     CH  15-28     120-80  2.2606   200-120 -2.1760    500-200   .3616   10M
     CH  29-42     120-80  3.0619   200-120 -3.0922    500-200   .5523   15M
     CH  43-56     120-80  3.5004   200-120 -3.5886    500-200   .7478   20M
     CH  57-70     120-80  3.6884   200-120 -3.7448    500-200  1.1789   25M
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1972 AUG STATION 60 DEPTH 12 M PA 10**4 AVG 5 DEPTH 25
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-24    120-80   .0992  200-120   .5455  500-200  -.3820   5M
     CH  25-48    120-80  1.0234  200-120  1.0483  500-200  -.2651  10M

1972 AUG STATION 62 DEPTH 169 METERS PREAMP 10**4 AVE 5 DEPTH 210
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 2    120-80  -.1066  200-120   .0604  500-200   .1211   5M
     CH   3- 4    120-80  -.1391  200-120   .1465  500-200   .2243  10M
     CH   5- 6    120-80  -.1622  200-120   .2277  500-200   .3384  15M
     CH   7- 8    120-80  -.1808  200-120   .2852  500-200   .4514  20M
     CH   9-10    120-80  -.2063  200-120   .3331  500-200   .5607  25M
     CH  11-12    120-80  -.2590  200-120   .3765  500-200   .6680  30M
     CH  13-14    120-80  -.2998  200-120   .4198  500-200   .7942  35M
     CH  15-16    120-80  -.3236  200-120   .4547  500-200   .9515  40M
     CH  17-18    120-80  -.3315  200-120   .4801  500-200  1.0799  45M
     CH  19-20    120-80  -.3553  200-120   .5209  500-200  1.2030  50M
     CH  21-22    120-80  -.3826  200-120   .5625  500-200  1.3216  55M
     CH  23-24    120-80  -.4095  200-120   .6047  500-200  1.4424  60M
     CH  25-26    120-80  -.4364  200-120   .6443  500-200  1.5614  65M
     CH  27-28    120-80  -.4632  200-120   .6793  500-200  1.6754  70M
     CH  29-30    120-80  -.4939  200-120   .7218  500-200  1.7905  75M
     CH  31-32    120-80  -.5264  200-120   .7602  500-200  1.9062  80M
     CH  33-34    120-80  -.5572  200-120   .8003  500-200  2.0184  85M
     CH  35-36    120-80  -.5858  200-120   .8380  500-200  2.1308  90M
     CH  37-38    120-80  -.6134  200-120   .8780  500-200  2.2424  95M
     CH  39-40    120-80  -.6410  200-120   .9218  500-200  2.3531 100M
     CH  41-42    120-80  -.6720  200-120   .9682  500-200  2.4621 105M
     CH  43-44    120-80  -.6990  200-120  1.0069  500-200  2.5724 110M
     CH  45-46    120-80  -.7232  200-120  1.0354  500-200  2.6825 115M
     CH  47-48    120-80  -.7531  200-120  1.0698  500-200  2.7943 120M
     CH  49-50    120-80  -.7859  200-120  1.1064  500-200  2.9029 125M
     CH  51-52    120-80  -.8181  200-120  1.1424  500-200  3.0101 130M
     CH  53-54    120-80  -.8423  200-120  1.1826  500-200  3.1206 135M
     CH  55-56    120-80  -.8794  200-120  1.2269  500-200  3.2292 140M
     CH  57-58    120-80  -.9143  200-120  1.2662  500-200  3.3377 145M
     CH  59-60    120-80  -.9443  200-120  1.3033  500-200  3.4473 150M
     CH  61-62    120-80  -.9666  200-120  1.3392  500-200  3.5552 155M
     CH  63-64    120-80  -.9965  200-120  1.3754  500-200  3.6640 160M
     CH  65-66    120-80 -1.0310  200-120  1.4129  500-200  3.7704 165M

1972 AUG STATION 64 DEPTH 85 METERS PREA 10**4 AVE 5 DEPTH  125
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 4    120-80  -.8392  200-120   .4728  500-200   .2732   5M
     CH   5- 8    120-80  -.2752  200-120  -.3633  500-200   .6212  10M
     CH   9-12    120-80 -1.3822  200-120  -.5458  500-200   .9708  15M
     CH  13-16    120-80 -1.6832  200-120  -.8314  500-200  1.3171  20M
     CH  17-20    120-80 -1.8047  200-120 -1.0135  500-200  1.6566  25M
     CH  21-24    120-80 -2.0649  200-120 -1.0911  500-200  1.9962  30M
     CH  25-28    120-80 -2.2202  200-120 -1.1473  500-200  2.3365  35M
     CH  29-32    120-80 -2.2819  200-120 -1.1559  500-200  2.6810  40M
     CH  33-36    120-80 -2.2746  200-120 -1.1409  500-200  3.0189  45M
     CH  37-40    120-80 -2.2744  200-120 -1.0975  500-200  3.3561  50M
     CH  41-44    120-80 -2.2787  200-120 -1.0655  500-200  3.6934  55M
     CH  45-48    120-80 -2.2831  200-120 -1.0352  500-200  4.0313  60M
     CH  49-52    120-80 -2.2671  200-120 -1.0129  500-200  4.3681  65M
     CH  53-56    120-80 -2.2821  200-120  -.9680  500-200  4.7051  70M
     CH  57-60    120-80 -2.3054  200-120  -.9203  500-200  5.0427  75M
     CH  61-64    120-80 -2.3208  200-120  -.8853  500-200  5.3799  80M
     CH  65-68    120-80 -2.3373  200-120  -.8448  500-200  5.7186  85M
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1972 AUG STATION 66 DEPTH 26 DEPTH 30 PA 10**4 AVE 5
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-17      120-80  -.3700   200-120    .1288   500-200    .1896   5M
     CH   18-34      120-80  -.5099   200-120    .1770   500-200    .3870  10M
     CH   35-51      120-80  -.5419   200-120    .2291   500-200    .5860  15M
     CH   52-68      120-80  -.5302   200-120    .2840   500-200    .7862  20M
     CH   69-85      120-80  -.5112   200-120    .3471   500-200    .9878  25M
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1972 AUG STATION 67 DEPTH 20 METERS PREAMP  10*4 AVE 5 DEPTH 25
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-20      120-80   .0975   200-120  -.5574   500-200  -.1659   5M
     CH   21-40      120-80   .6068   200-120   .3514   500-200  -.0423  10M
     CH   41-60      120-80  -.0899   200-120   .8659   500-200   .0780  15M
     CH   61-80      120-80  -.2030   200-120  1.2535   500-200   .1856  20M
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1972 AUG STATION 69 DEPTH 152 DEPTH 180 PREAMP 10**4 AVE 5
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2      120-80   .0672   200-120  -.0933   500-200   .0594   5M
     CH    3- 4      120-80   .0314   200-120  -.2520   500-200   .2172  10M
     CH    5- 6      120-80   .0043   200-120  -.3654   500-200   .3728  15M
     CH    7- 8      120-80  -.1876   200-120  -.4749   500-200   .5394  20M
     CH    9-10      120-80  -.2187   200-120  -.5747   500-200   .6946  25M
     CH   11-12      120-80  -.1928   200-120  -.7134   500-200   .8563  30M
     CH   13-14      120-80  -.1824   200-120  -.8416   500-200  1.0119  35M
     CH   15-16      120-80  -.1794   200-120  -.9566   500-200  1.2111  40M
     CH   17-18      120-80  -.1777   200-120 -1.0699   500-200  1.4122  45M
     CH   19-20      120-80  -.1851   200-120 -1.1730   500-200  1.5986  50M
     CH   21-22      120-80  -.1796   200-120 -1.2852   500-200  1.8027  55M
     CH   23-24      120-80  -.1859   200-120 -1.3911   500-200  1.9889  60M
     CH   25-26      120-80  -.1951   200-120 -1.4966   500-200  2.1721  65M
     CH   27-28      120-80  -.2009   200-120 -1.6010   500-200  2.3552  70M
     CH   29-30      120-80  -.2073   200-120 -1.7477   500-200  2.5377  75M
     CH   31-32      120-80  -.2124   200-120 -1.8036   500-200  2.7258  80M
     CH   33-34      120-80  -.2237   200-120 -2.0365   500-200  2.9023  85M
     CH   35-36      120-80  -.2309   200-120 -2.1884   500-200  3.0792  90M
     CH   37-38      120-80  -.2373   200-120 -2.3340   500-200  3.2505  95M
     CH   39-40      120-80  -.2470   200-120 -2.4760   500-200  3.4137 100M
     CH   41-42      120-80  -.2528   200-120 -2.6244   500-200  3.5732 105M
     CH   43-44      120-80  -.2587   200-120 -2.7686   500-200  3.7377 110M
     CH   45-46      120-80  -.2635   200-120 -2.9120   500-200  3.8860 115M
     CH   47-48      120-80  -.2633   200-120 -3.0536   500-200  4.0520 120M
     CH   49-50      120-80  -.2588   200-120 -3.1974   500-200  4.2133 125M
     CH   51-52      120-80  -.2642   200-120 -3.3361   500-200  4.3646 130M
     CH   53-54      120-80  -.2707   200-120 -3.4763   500-200  4.5177 135M
     CH   55-56      120-80  -.2764   200-120 -3.6132   500-200  4.6520 140M
     CH   57-58      120-80  -.2780   200-120 -3.7510   500-200  4.8036 145M
     CH   59-60      120-80  -.2891   200-120 -3.8897   500-200  4.9395 150M
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1972 AUG STATION 71 DEPTH 186 AVE 5 PREAMP 10**44 DEPTH 235
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2      120-80  -.1804   200-120  1.2288    500-200  -.1572   5M
     CH    3- 4      120-80  -.4407   200-120  1.5778    500-200   .3856  10M
     CH    5- 6      120-80  -.7016   200-120  1.7188    500-200   .9394  15M
     CH    7- 8      120-80  -.9374   200-120  1.8124    500-200  1.4929  20M
     CH    9-10      120-80 -1.1700   200-120  1.9095    500-200  2.0310  25M
     CH   11-12      120-80 -1.4033   200-120  2.0154    500-200  2.5757  30M
     CH   13-14      120-80 -1.6395   200-120  2.1246    500-200  3.1160  35M
     CH   15-16      120-80 -1.8798   200-120  2.2365    500-200  3.6593  40M
     CH   17-18      120-80 -2.1224   200-120  2.3513    500-200  4.1985  45M
     CH   19-20      120-80 -2.3552   200-120  2.4641    500-200  4.7347  50M
     CH   21-22      120-80 -2.5999   200-120  2.5795    500-200  5.2780  55M
     CH   23-24      120-80 -2.8414   200-120  2.6906    500-200  5.8084  60M
     CH   25-26      120-80 -3.0774   200-120  2.7966    500-200  6.3344  65M
     CH   27-28      120-80 -3.3123   200-120  2.8938    500-200  6.8644  70M
     CH   29-30      120-80 -3.5462   200-120  2.9882    500-200  7.3901  75M
     CH   31-32      120-80 -3.7712   200-120  3.0811    500-200  7.9232  80M
     CH   33-34      120-80 -3.9970   200-120  3.1803    500-200  8.4452  85M
     CH   35-36      120-80 -4.2286   200-120  3.2868    500-200  8.9724  90M
     CH   37-38      120-80 -4.4627   200-120  3.3885    500-200  9.4906  95M
     CH   39-40      120-80 -4.6888   200-120  3.4789    500-200 10.0090 100M
     CH   41-42      120-80 -4.9194   200-120  3.5766    500-200 10.5298 105M
     CH   43-44      120-80 -5.1481   200-120  3.6706    500-200 11.0528 110M
     CH   45-46      120-80 -5.3768   200-120  3.7638    500-200 11.5617 115M
     CH   47-48      120-80 -5.6088   200-120  3.8596    500-200 12.0824 120M
     CH   49-50      120-80 -5.8369   200-120  3.9561    500-200 12.6052 125M
     CH   51-52      120-80 -6.0728   200-120  4.0616    500-200 13.1188 130M
     CH   53-54      120-80 -6.3112   200-120  4.1699    500-200 13.6348 135M
     CH   55-56      120-80 -6.5465   200-120  4.2814    500-200 14.1596 140M
     CH   57-58      120-80 -6.7912   200-120  4.4011    500-200 14.7138 145M
     CH   59-60      120-80 -7.0314   200-120  4.5146    500-200 15.2569 150M
     CH   61-62      120-80 -7.2649   200-120  4.6215    500-200 15.8098 155M
     CH   63-64      120-80 -7.5024   200-120  4.7312    500-200 16.3598 160M
     CH   65-66      120-80 -7.7342   200-120  4.8442    500-200 16.9131 165M
     CH   67-68      120-80 -7.9665   200-120  4.9517    500-200 17.4651 170M
     CH   69-70      120-80 -8.1971   200-120  5.0563    500-200 18.0086 175M
     CH   71-72      120-80 -8.4287   200-120  5.1597    500-200 18.5610 180M
     CH   73-74      120-80 -8.6630   200-120  5.2719    500-200 19.1014 185M

1972 AUG STATION 72 DEPTH 32 PREAMP 10**4 AVE 5 DEPTH 41
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-13      120-80   .0035   200-120  1.2893    500-200   .1968   5M
     CH   14-26      120-80  -.0216   200-120  1.8298    500-200   .9246  10M
     CH   27-39      120-80   .7510   200-120  2.1153    500-200  1.6104  15M
     CH   40-52      120-80  1.5563   200-120  2.1656    500-200  2.2982  20M
     CH   53-65      120-80  1.7330   200-120  2.5747    500-200  2.9821  25M
     CH   66-78      120-80  3.2815   200-120  1.4586    500-200  3.6750  30M

1972 AUG STATION 73 DEPTH 17 AVE 5 PREAMP 10**4 DEPTH 24
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-23      120-80  -.0482   200-120   .6278    500-200  -.3105   5M
     CH   24-46      120-80  -.0077   200-120   .3349    500-200   .2471  10M
     CH   47-69      120-80   .8032   200-120  -.3910    500-200   .7836  15M
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1972 AUG STATION 75 DEPTH 233 METERS PREAMP 10**4 AVE 5 DEPTH 0250
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2     120-80    .0521   200-120    .0970   500-200    .0072    5M
     CH    3- 4     120-80    .0551   200-120    .1323   500-200    .0388   10M
     CH    5- 6     120-80    .0496   200-120    .1664   500-200    .0750   15M
     CH    7- 8     120-80    .1865   200-120    .0785   500-200    .1152   20M
     CH    9-10     120-80    .2422   200-120    .0676   500-200    .1574   25M
     CH   11-12     120-80    .2352   200-120    .0967   500-200    .2019   30M
     CH   13-14     120-80    .2155   200-120    .1326   500-200    .2463   35M
     CH   15-16     120-80    .1989   200-120    .1678   500-200    .2888   40M
     CH   17-18     120-80    .1721   200-120    .2059   500-200    .3303   45M
     CH   19-20     120-80    .1416   200-120    .2430   500-200    .3757   50M
     CH   21-22     120-80    .1347   200-120    .2589   500-200    .4204   55M
     CH   23-24     120-80    .1087   200-120    .2942   500-200    .4646   60M
     CH   25-26     120-80    .0804   200-120    .3348   500-200    .5079   65M
     CH   27-28     120-80    .0495   200-120    .3706   500-200    .5498   70M
     CH   29-30     120-80    .0199   200-120    .4072   500-200    .5941   75M
     CH   31-32     120-80   -.0118   200-120    .4438   500-200    .6395   80M
     CH   33-34     120-80   -.0453   200-120    .4851   500-200    .6862   85M
     CH   35-36     120-80   -.0725   200-120    .5234   500-200    .7330   90M
     CH   37-38     120-80   -.0927   200-120    .5567   500-200    .7783   95M
     CH   39-40     120-80   -.1202   200-120    .5896   500-200    .8225  100M
     CH   41-42     120-80   -.1485   200-120    .6238   500-200    .8665  105M
     CH   43-44     120-80   -.1757   200-120    .6567   500-200    .9123  110M
     CH   45-46     120-80   -.2062   200-120    .6910   500-200    .9578  115M
     CH   47-48     120-80   -.2063   200-120    .6939   500-200   1.0037  120M
     CH   49-50     120-80   -.2171   200-120    .7128   500-200   1.0487  125M
     CH   51-52     120-80   -.2379   200-120    .7432   500-200   1.0920  130M
     CH   53-54     120-80   -.3250   200-120    .7760   500-200   1.1382  135M
     CH   55-56     120-80   -.3773   200-120    .8110   500-200   1.1838  140M
     CH   57-58     120-80   -.4076   200-120    .8424   500-200   1.2290  145M
     CH   59-60     120-80   -.4388   200-120    .8763   500-200   1.2750  150M
     CH   61-62     120-80   -.4680   200-120    .9120   500-200   1.3208  155M
     CH   63-64     120-80   -.4954   200-120    .9444   500-200   1.3646  160M
     CH   65-66     120-80   -.5233   200-120    .9778   500-200   1.4117  165M
     CH   67-68     120-80   -.5513   200-120   1.0113   500-200   1.4561  170M
     CH   69-70     120-80   -.5801   200-120   1.0475   500-200   1.5013  175M
     CH   71-72     120-80   -.6094   200-120   1.0830   500-200   1.5472  180M
     CH   73-74     120-80   -.6379   200-120   1.1170   500-20    1.5942  185M
     CH   75-76     120-80   -.6659   200-120   1.1452   500-200   1.6410  190M
     CH   77-78     120-80   -.6957   200-120   1.1793   500-200   1.6842  195M
     CH   79-80     120-80   -.7246   200-120   1.2160   500-200   1.7231  200M
     CH   81-82     120-80   -.7470   200-120   1.2507   500-200   1.7701  205M
     CH   83-84     120-80   -.7710   200-120   1.2814   500-200   1.8172  210M
     CH   85-86     120-80   -.8052   200-120   1.3164   500-200   1.8631  215M
     CH   87-88     120-80   -.8364   200-120   1.3534   500-200   1.9085  220M
     CH   89-90     120-80   -.8714   200-120   1.3887   500-200   1.9555  225M
     CH   91-92     120-80   -.9040   200-120   1.4197   500-200   2.0050  230M

1972 AUG STATION 78 DEPTH 53 METERS PREAMP 10**4 AVE 5 DEPTH 60
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 8     120-80   -.5866   200-120   1.0277   500-200   -.4405    5M
     CH    9-16     120-80   -.7701   200-120   1.5975   500-200   -.1336   10M
     CH   17-24     120-80   -.2450   200-120   2.1723   500-200    .2780   15M
     CH   25-32     120-80   -.1715   200-120   3.8303   500-200    .7074   20M
     CH   33-40     120-80   -.1330   200-120   5.1836   500-200   1.1376   25M
     CH   41-48     120-80   -.1513   200-120   6.4204   500-200   1.5674   30M
     CH   49-56     120-80   -.4300   200-120   7.2193   500-200   1.9947   35M
     CH   57-64     120-80   -.2914   200-120   7.6423   500-200   2.4212   40M
     CH   65-72     120-80   -.1148   200-120   7.7984   500-200   2.8492   45M
     CH   73-80     120-80   -.1798   200-120   8.2346   500-200   3.2749   50M
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1972 AUG STATION 79 DEPTH 20 METERS AVE 5 PRE 10**4 DEPTH 30
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-16       120-80  -.5073   200-120   .5335   500-200   .8295   5M
     CH  17-32       120-80 -1.0146   200-120  1.0658   500-200  1.6354  10M
     CH  33-48       120-80 -1.5217   200-120  1.5971   500-200  2.4333  15M
     CH  49-64       120-80 -2.0290   200-120  2.1279   500-200  3.2339  20M
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1972 . . - -
     AUG STATION 83 DEPTH 99 METERS PRE 10**4 AVE 5 DEPTH 140
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 3       120-80  1.9414   200-120 -2.9074   500-200 -1.0924   5M
     CH   4- 6       120-80  3.2773   200-120 -3.3017   500-200 -2.7439  10M
     CH   7- 9       120-80  2.7640   200-120 -2.0621   500-200 -4.4289  15M
     CH  10-12       120-80  2.1784   200-120  -.3913   500-200 -6.1054  20M
     CH  13-15       120-80  3.3679   200-120  -.4644   500-200 -7.7837  25M
     CH  16-18       120-80  4.9012   200-120  -.4324   500-200 -9.4589  30M
     CH  19-21       120-80  6.4466   200-120  -.3228   500-200-11.1347  35M
     CH  22-24       120-80  8.0397   200-120  -.2156   500-200-12.8102  40M
     CH  25-27       120-80  9.5701   200-120  -.0897   500-200-14.4849  45M
     CH  28-30       120-80 11.1340   200-120  -.0023   500-200-16.1599  50M
     CH  31-33       120-80 12.7147   200-120   .0754   500-200-17.8325  55M
     CH  34-36       120-80 14.2706   200-120   .1709   500-200-19.5047  60M
     CH  37-39       120-80 15.8255   200-120   .2710   500-200-21.1776  65M
     CH  40-42       120-80 17.3766   200-120   .3781   500-200-22.8502  70M
     CH  43-45       120-80 18.9197   200-120   .4899   500-200-24.5223  75M
     CH  46-48       120-80 20.4682   200-120   .5879   500-200-26.1928  80M
     CH  49-51       120-80 22.0417   200-120   .6696   500-200-27.8632  85M
     CH  52-54       120-80 23.5701   200-120   .7657   500-200-29.5354  90M
     CH  55-57       120-80 25.1159   200-120   .8677   500-200-31.2061  95M
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1972 AUG STATION 85 DEPTH 188 PREAMP 10**4 AVE 5 DEPTH 230
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2      120-80  -.0835   200-120  -.7370   500-200   3.3257   5M
     CH    3- 4      120-80  1.3485   200-120  -.1650   500-200   5.3887  10M
     CH    5- 6      120-80  1.4091   200-120   .5024   500-200   7.4320  15M
     CH    7- 8      120-80  1.4918   200-120  1.2160   500-200   9.4740  20M
     CH    9-10      120-80  1.6565   200-120  1.9057   500-200  11.5120  25M
     CH   11-12      120-80  1.8006   200-120  2.6341   500-200  13.5475  30M
     CH   13-14      120-80  1.9579   200-120  3.3476   500-200  15.5826  35M
     CH   15-16      120-80  2.0879   200-120  4.0772   500-200  17.6119  40M
     CH   17-18      120-80  2.2076   200-120  4.8099   500-200  19.6432  45M
     CH   19-20      120-80  2.3644   200-120  5.5140   500-200  21.6714  50M
     CH   21-22      120-80  2.4961   200-120  6.2411   500-200  23.6999  55M
     CH   23-24      120-80  2.6164   200-120  6.9727   500-200  25.7260  60M
     CH   25-26      120-80  2.7287   200-120  7.7033   500-200  27.7541  65M
     CH   27-28      120-80  2.8469   200-120  8.4347   500-200  29.7804  70M
     CH   29-30      120-80  2.9692   200-120  9.1713   500-200  31.8047  75M
     CH   31-32      120-80  3.0910   200-120  9.9033   500-200  33.8288  80M
     CH   33-34      120-80  3.2068   200-120 10.6352   500-200  35.8536  85M
     CH   35-36      120-80  3.3270   200-120 11.3659   500-200  37.8793  90M
     CH   37-38      120-80  3.4410   200-120 12.0990   500-200  39.8997  95M
     CH   39-40      120-80  3.5612   200-120 12.8298   500-200  41.9213 100M
     CH   41-42      120-80  3.6890   200-120 13.5607   500-200  43.9440 105M
     CH   43-44      120-80  3.8102   200-120 14.2914   500-200  45.9638 110M
     CH   45-46      120-80  3.9267   200-120 15.0247   500-200  47.9826 115M
     CH   47-48      120-80  4.0378   200-120 15.7565   500-200  50.0050 120M
     CH   49-50      120-80  4.1459   200-120 16.4899   500-200  52.0251 125M
     CH   51-52      120-80  4.2638   200-120 17.2165   500-200  54.0448 130M
     CH   53-54      120-80  4.3835   200-120 17.9442   500-200  56.0651 135M
     CH   55-56      120-80  4.5078   200-120 18.6721   500-200  58.0841 140M
     CH   57-58      120-80  4.6255   200-120 19.4039   500-200  60.1045 145M
     CH   59-60      120-80  4.7408   200-120 20.1333   500-200  62.1256 150M
     CH   61-62      120-80  4.8479   200-120 20.8674   500-200  64.1440 155M
     CH   63-64      120-80  4.9569   200-120 21.6026   500-200  66.1632 160M
     CH   65-66      120-80  5.0659   200-120 22.3345   500-200  68.1826 165M
     CH   67-68      120-80  5.1810   200-120 23.0652   500-200  70.2021 170M
     CH   69-70      120-80  5.2936   200-120 23.7969   500-200  72.2203 175M
     CH   71-72      120-80  5.4152   200-120 24.5220   500-200  74.2350 180M
     CH   73-74      120-80  5.5331   200-120 25.2539   500-200  76.2541 185M

1972 AUG STATION 89 DEPTH 76 METERS PREAMP 10**4 AVE 5 DEPTH 110
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 4      120-80   .0942   200-120  -.7729   500-200   3.1557   5M
     CH    5- 8      120-80   .1881   200-120   .7602   500-200   5.5635  10M
     CH    9-12      120-80   .2819   200-120  2.0368   500-200   7.9402  15M
     CH   13-16      120-80   .3756   200-120  3.2336   500-200  10.3287  20M
     CH   17-20      120-80   .7601   200-120  4.4253   500-200  12.7116  25M
     CH   21-24      120-80  -.5563   200-120  6.3879   500-200  15.0783  30M
     CH   25-28      120-80   .5447   200-120  6.9047   500-200  17.4518  35M
     CH   29-32      120-80  1.9281   200-120  7.5444   500-200  19.8228  40M
     CH   33-36      120-80  3.3494   200-120  8.2394   500-200  22.1902  45M
     CH   37-40      120-80  4.7749   200-120  8.9431   500-200  24.5606  50M
     CH   41-44      120-80  6.2385   200-120  9.6776   500-200  26.9285  55M
     CH   45-48      120-80  7.7108   200-120 10.3669   500-200  29.2968  60M
     CH   49-52      120-80  9.1733   200-120 11.0593   500-200  31.6645  65M
     CH   53-56      120-80 10.6131   200-120 11.7678   500-200  34.0336  70M
     CH   57-60      120-80 12.0490   200-120 12.4843   500-200  36.4006  75M
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1972
     AUG STATION 90 DEPTH 13 METERS PREAMP 10**4 AVE 5 DEPTH 27
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-24      120-80    .0488    200-120  1.8738    500-200  -.0346   5M
     CH  25-48      120-80  -.6690     200-120  2.2172    500-200   .0168  10M

1972 AUG STATION 92 DEPTH0 67 METERS PREAMP 10**4 AVE 5 DEPTH 80
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 6      120-80    .1614    200-120  1.1314    500-200   .3615   5M
     CH   7-12      120-80    .2095    200-120  1.6034    500-200   .9856  10M
     CH  13-18      120-80    .1890    200-120  1.7625    500-200  1.6254  15M
     CH  19-24      120-80    .1249    200-120  1.8882    500-200  2.2605  20M
     CH  25-30      120-80  -.0290     200-120  1.9955    500-200  2.8926  25M
     CH  31-36      120-80  -.0559     200-120  2.2279    500-200  3.5217  30M
     CH  37-42      120-80  -.0432     200-120  2.4157    500-200  4.1405  35M
     CH  43-48      120-80    .0024    200-120  2.5094    500-200  4.7505  40M
     CH  49-54      120-80    .0005    200-120  2.6409    500-200  5.3515  45M
     CH  55-60      120-80  -.0176     200-120  2.7970    500-200  5.9423  50M
     CH  61-66      120-80  -.0080     200-120  2.9171    500-200  6.5281  55M
     CH  67-72      120-80    .0106    200-120  3.0194    500-200  7.1101  60M
     CH  73-78      120-80    .0027    200-120  3.1352    500-200  7.6879  65M

1972 AUG STATION 94 DEPTH 35 METERS PREAP 10**4 AVE 5 DEPTH 45
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-11      120-80    .7611    200-120  1.0744    500-200   .2940   5M
     CH  12-22      120-80   1.5873    200-120  1.5066    500-200   .6000  10M
     CH  23-33      120-80   2.1540    200-120  1.5867    500-200   .8905  15M
     CH  34-44      120-80   2.7801    200-120  1.3975    500-200  1.1099  20M
     CH  45-55      120-80   3.4210    200-120  1.0677    500-200  1.3764  25M
     CH  56-66      120-80   4.3513    200-120   .7495    500-200  1.6584  30M
     CH  67-77      120-80   3.5186    200-120   .2747    500-200  1.9416  35M

1972=AUG STATION 96 DEPTH 35 METERS PER 10**4 AVE 5 DEPTH 45
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-11      120-80    .7127    200-120   .4800    500-200  -.9400   5M
     CH  12-22      120-80   1.4250    200-120   .1084    500-200  -.9039  10M
     CH  23-33      120-80   2.1370    200-120  1.7959    500-200  -.9166  15M
     CH  34-44      120-80   2.8488    200-120  2.3794    500-200  -.9377  20M
     CH  45-55      120-80   3.5603    200-120  2.2085    500-200  -.9662  25M
     CH  56-66      120-80   4.2716    200-120  1.5924    500-200  -.9853  30M
     CH  67-77      120-80   4.9827    200-120   .7074    500-200 -1.0021  35M
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1972 AUG STATION 95 DEPTH 18METERS AVE 5 PRE 10**4 DETH 30
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-20      120-80    .0969   200-120    .5313    500-200  1.4301    5M
     CH   21-40      120-80    .1936   200-120   1.0621    500-200  2.8520   10M
     CH   41-60      120-80    .2903   200-120   1.5924    500-200  4.2728   15M
1972
     AUG STATION 97 DEPTH 29 MEYTERS PRE 10**4 AVE 5 DEPTH 42
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-13      120-80    .2513   200-120    .3475    500-200  -.3607    5M
     CH   14-26      120-80    .5025   200-120   -.0884    500-200  -.3802   10M
     CH   27-39      120-80    .7536   200-120  -1.0739    500-200  -.4178   15M
     CH   40-52      120-80   1.1437   200-120  -2.3232    500-200  -.4588   20M
     Ch   53-65      120-80   2.0047   200-120  -3.8202    500-200  -.4964   25M

1972 AUG STATION 98 DEPTH 22 METERS PRE 10**4 AVE   DEPTH 45
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-12      120-80   -.3069   200-120   -.0308    500-200   .2527    5M
     CH   13-24      120-80  -1.1058   200-120    .2586    500-200   .8825   10M
     CH   25-36      120-80   -.7386   200-120    .9981    500-200  1.5005   15M
     CH   37-48      120-80   -.4742   200-120    .8523    500-200  2.1069   20M

1972 AUG STATION 99 DEPTH 40 METERS PREAMP 10**4 AVE 5 DEPTH 51
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 9      120-80    .2913   200-120    .7097    500-200   .1723    5M
     CH   10-18      120-80   -.4882   200-120    .9494    500-200   .9309   10M
     CH   19-27      120-80   -.8070   200-120   2.2671    500-200  1.6757   15M
     CH   28-36      120-80  -1.0380   200-120   2.8857    500-200  2.4133   20M
     CH   37-45      120-80  -2.0604   200-120   3.6385    500-200  3.1366   25M
     CH   46-54      120-80  -1.6961   200-120   2.4831    500-200  3.8661   30M
     CH   55-63      120-80  -1.2820   200-120   1.1293    500-200  4.5844   35M
     CH   64-72      120-80  -1.2610   200-120    .1088    500-200  5.3165   40M

1972 AUG STATION 103 DEPTH 21 METERS PREAMP 10**4 OVE 5 DEPTH 25
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-20      120-80    .8973   200-120    .6000    500-200  -.0238    5M
     CH   21-40      120-80    .4600   200-120    .2540    500-200  -.0527   10M
     CH   41-60      120-80    .6174   200-120   -.3432    500-200  -.0865   15M
     CH   61-80      120-80    .8885   200-120  -1.1851    500-200   .0052   20M

1972 AUG STATION 105 DEPTH 26 METERS PREAMP 10**4 AVE 5 DEPTH 30
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-17      120-80    .2742   200-120    .3470    500-200  -.2368    5M
     CH   18-34      120-80    .2003   200-120    .1739    500-200  -.1487   10M
     CH   35-51      120-80  -1.2186   200-120   2.1056    500-200  -.0537   15M
     CH   52-68      120-80  -2.1356   200-120   2.9741    500-200   .0536   20M
     CH   69-85      120-80  -2.9902   200-120   3.4154    500-200   .1530   25M
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1972 NOV STATION 1  PA 10**4 AVG 5 DEPTH 44 M SCAN 50 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-11     120-80  -.6977   200-120  -.1475   500-200   .6816   5M
     CH  12-22     120-80  -.7373   200-120  -.1488   500-200   .8320  10M
     CH  23-33     120-80  -.7905   200-120  -.0793   500-200   .9730  15M
     CH  34-44     120-80  -.8207   200-120  -.0416   500-200  1.1087  20M
     CH  45-55     120-80  -.8121   200-120   .0027   500-200  1.2418  25M
     CH  56-66     120-80  -.7774   200-120  -.0149   500-200  1.3725  30M
     CH  67-77     120-80  -.7748   200-120   .0180   500-200  1.5090  35M
     CH  78-88     120-80  -.7827   200-120   .0546   500-200  1.5819  40M

1972 NOV STATION 2 PA 10**4 AVG 5 DEPTH 20 M SCAN 25 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-20     120-80   .0978   200-120  -.0274   500-200   .1870   5M
     CH  21-40     120-80  -.2482   200-120  1.3897   500-200   .4249  10M
     CH  41-60     120-80  -.4903   200-120  1.4362   500-200   .6835  15M
     CH  61-80     120-80  -.7826   200-120  1.4663   500-200   .8851  20M

1972 NOV STATION 3 PA 10**4 AVE 5 DEPTH 22 M DEPTH 30 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-18     120-80  -.9900   200-120  -.3102   500-200   .1286   5M
     CH  19-36     120-80 -1.0165   200-120  -.1315   500-200   .0759  10M
     CH  37-54     120-80  -.9116   200-120   .0287   500-200   .0433  15M
     CH  55-72     120-80  -.8384   200-120   .1239   500-200   .0082  20M

1972 NOV STATION 5 PA 10**4 AVG 5 DEPTH 115 M SCAN 150 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 3     120-80  -.3767   200-120  1.7085   500-200  -.4828   5M
     CH   4- 6     120-80 -1.3035   200-120  1.7442   500-200  -.2609  10M
     CH   7- 9     120-80 -1.3998   200-120  1.4211   500-200  -.0448  15M
     CH  10-12     120-80 -1.5621   200-120  1.4854   500-200   .1946  20M
     CH  13-15     120-80 -1.7383   200-120  1.6507   500-200   .4167  25M
     CH  16-18     120-80 -1.8301   200-120  1.8086   500-200   .6310  30M
     CH  19-21     120-80 -1.8365   200-120  1.9572   500-200   .8529  35M
     CH  22-24     120-80 -1.8351   200-120  2.1003   500-200  1.0679  40M
     CH  25-27     120-80 -1.8367   200-120  2.2351   500-200  1.2909  45M
     CH  28-30     120-80 -1.8483   200-120  2.3779   500-200  1.5113  50M
     CH  31-33     120-80 -1.8625   200-120  2.5273   500-200  1.7235  55M
     CH  34-36     120-80 -1.8737   200-120  2.6705   500-200  1.9617  60M
     CH  37-39     120-80 -1.8879   200-120  2.8144   500-200  2.1948  65M
     CH  40-42     120-80 -1.8925   200-120  2.9553   500-200  2.4146  70M
     CH  43-45     120-80 -1.8957   200-120  3.0912   500-200  2.6342  75M
     CH  46-48     120-80 -1.9150   200-120  3.2329   500-200  2.8701  80M
     CH  49-51     120-80 -1.9171   200-120  3.3712   500-200  3.0823  85M
     CH  52-54     120-80 -1.9216   200-120  3.5105   500-200  3.3141  90M
     CH  55-57     120-80 -1.9267   200-120  3.6554   500-200  3.5496  95M
     CH  58-60     120-80 -1.9433   200-120  3.8045   500-200  3.7914 100M
     CH  61-63     120-80 -1.9597   200-120  3.9545   500-200  4.0065 105M
     CH  64-66     120-80 -1.9767   200-120  4.1034   500-200  4.2293 110M
     CH  67-69     120-80 -1.9825   200-120  4.2409   500-200  4.4587 115M
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1972 NOV STATION 7 PA 10**4 AVG 5 DEPTH 24 M SCAN 40 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-15      120-80  1.2347   200-120 -1.5888   500-200    .2447   5M
     CH  16-30      120-80  1.8242   200-120 -2.0690   500-200    .4064  10M
     CH  31-45      120-80  1.7908   200-120 -1.9488   500-200    .7412  15M
     CH  46-60      120-80  1.7380   200-120 -1.8043   500-200    .8117  20M


1972 NOV STATION 8 PA 10**4 AVE 5 DEPTH 70 M SWEEP 77 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 6      120-80   .0953   200-120   .5177   500-200  -.7070   5M
     CH   7-12      120-80   .1934   200-120  1.0353   500-200  -.5242  10M
     CH  13-18      120-80  -.2051   200-120  2.6869   500-200  -.3591  15M
     CH  19-24      120-80   .7839   200-120  1.4259   500-200  -.1931  20M
     CH  25-30      120-80  1.1476   200-120   .2768   500-200  -.0270  25M
     CH  31-36      120-80   .8243   200-120  -.2400   500-200   .1412  30M
     CH  37-42      120-80   .2090   200-120  -.4401   500-200   .3103  35M
     CH  43-48      120-80  -.5303   200-120  -.4928   500-200   .4797  40M
     CH  49-54      120-80 -1.2206   200-120  -.4686   500-200   .6485  45M
     CH  55-60      120-80 -1.2314   200-120  -.4228   500-200   .8207  50M
     CH  61-66      120-80 -2.5254   200-120  -.3481   500-200   .9912  55M
     CH  67-72      120-80 -3.5171   200-120  -.2941   500-200  1.1624  60M
     CH  73-78      120-80 -4.3524   200-120  -.2232   500-200  1.3324  65M
     CH  79-84      120-80 -4.8043   200-120  -.1497   500-200  1.5017  70M


1972 NOV STATION 10 PA 10**4 AVG 5 DEPTH 121 M SWEEP 160 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 3      120-80   .5541   200-120 -1.4331   500-200   .0103   5M
     CH   4- 6      120-80   .0501   200-120 -1.9139   500-200   .1655  10M
     CH   7- 9      120-80   .0301   200-120 -2.2101   500-200   .3193  15M
     CH  10-12      120-80  -.1143   200-120 -2.1341   500-200   .4750  20M
     CH  13-15      120-80  -.2245   200-120 -2.0619   500-200   .6311  25M
     CH  16-18      120-80  -.2818   200-120 -1.9978   500-200   .7905  30M
     CH  19-21      120-80  -.3293   200-120 -1.9312   500-200   .9452  35M
     CH  22-24      120-80  -.3555   200-120 -1.8664   500-200  1.1022  40M
     CH  25-27      120-80  -.3597   200-120 -1.8111   500-200  1.2559  45M
     CH  28-30      120-80  -.3706   200-120 -1.7459   500-200  1.4079  50M
     CH  31-33      120-80  -.3766   200-120 -1.6769   500-200  1.5619  55M
     CH  34-36      120-80  -.3872   200-120 -1.6061   500-200  1.7167  60M
     CH  37-39      120-80  -.3873   200-120 -1.5382   500-200  1.8678  65M
     CH  40-42      120-80  -.38[illegible]4   200-120 -1.4880   500-200  2.0289  70M
     CH  43-45      120-80  -.3980   200-120 -1.4272   500-200  2.1882  75M
     CH  46-48      120-80  -.4061   200-120 -1.3634   500-200  2.3419  80M
     CH  49-51      120-80  -.4158   200-120 -1.3067   500-200  2.4982  85M
     CH  52-54      120-80  -.4339   200-120 -1.2431   500-200  2.6499  90M
     CH  55-57      120-80  -.4453   200-120 -1.1807   500-200  2.8015  95M
     CH  58-60      120-80  -.4609   200-120 -1.1118   500-200  2.9555 100M
     CH  61-63      120-80  -.4681   200-120 -1.0491   500-200  3.1036 105M
     CH  64-66      120-80  -.4769   200-120   -.9920  500-200  3.2597 110M
     CH  67-69      120-80  -.4882   200-120   -.9354  500-200  3.4135 115M
     CH  70-72      120-80  -.5126   200-120   -.8684  500-200  3.5688 120M
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1972 NOV STATION 12 PA 10**4 AVG 5 DEPTH 27 M SCAN 34 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-15     120-80   .0924   200-120  -.2057   500-200   .0587    5M
     CH  16-30     120-80  -.0880   200-120  1.3242   500-200   .2464   10M
     CH  31-45     120-80 -1.0226   200-120  2.4418   500-200   .4246   15M
     CH  46-60     120-80  -.4519   200-120  1.4596   500-200   .6069   20M
     CH  61-75     120-80 -1.3085   200-120   .8104   500-200   .7862   25M
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1972 NOV STATION 14 PA 10**4 AVG 5 DEPTH 15 M SCAN 19 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-26     120-80  -.2593   200-120   .1821   500-200  -.3249    5M
     CH  27-52     120-80  -.6868   200-120  -.2926   500-200  -.2127   10M
     CH  53-78     120-80  -.3162   200-120   .6333   500-200   .0316   15M
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1972 NOV STATION 15 PA 10**4 AVG 5 DEPTH 102 M SCAN 150 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 3     120-80   .0251   200-120  -.2582   500-200  -.0411    5M
     CH   4- 6     120-80   .6095   200-120  -.9864   500-200   .1592   10M
     CH   7- 9     120-80  1.0050   200-120 -1.8701   500-200   .3447   15M
     CH  10-12     120-80  2.2499   200-120 -3.0962   500-200   .5294   20M
     CH  13-15     120-80  2.3311   200-120 -3.1674   500-200   .7145   25M
     CH  16-18     120-80  2.2227   200-120 -3.0844   500-200   .8987   30M
     CH  19-21     120-80  2.1322   200-120 -3.0011   500-200  1.0839   35M
     CH  22-24     120-80  2.0160   200-120 -2.9185   500-200  1.2689   40M
     CH  25-27     120-80  1.9191   200-120 -2.8295   500-200  1.4573   45M
     CH  28-30     120-80  1.9030   200-120 -2.7739   500-200  1.6442   50M
     CH  31-33     120-80  1.9099   200-120 -2.7347   500-200  1.8321   55M
     CH  34-36     120-80  1.8[illegible]   200-120 -2.6521   500-200  2.0198   60M
     CH  37-39     120-80  1.880[illegible]   200-120 -2.5719   500-200  2.2039   65M
     CH  40-42     120-80  1.8661   200-120 -2.4916   500-200  2.3945   70M
     CH  43-45     120-80  1.8517   200-120 -2.4163   500-200  2.5787   75M
     CH  46-48     120-80  1.8420   200-120 -2.3383   500-200  2.7643   80M
     CH  49-51     120-80  1.8315   200-120 -2.2599   500-200  2.9502   85M
     CH  52-54     120-80  1.8223   200-120 -2.1773   500-200  3.1269   90M
     CH  55-57     120-80  1.8069   200-120 -2.1030   500-200  3.3110   95M
     CH  58-60     120-80  1.7968   200-120 -2.0371   500-200  3.4948  100M
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1972 NOV STATION 17 DEPTH 150 M PA 10**4 AVG 5 DEPTH 180
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2     120-80    .7646   200-120 -1.4088    500-200    .1158    5M
     CH    3- 4     120-80    .7174   200-120 -2.1263    500-200    .2739   10M
     CH    5- 6     120-80    .9866   200-120 -2.3593    500-200    .4235   15M
     CH    7- 8     120-80    .1466   200-120 -2.2655    500-200    .5737   20M
     CH    9-10     120-80  -.0651    200-120 -2.1834    500-200    .7231   25M
     CH   11-12     120-80  -.0731    200-120 -2.1011    500-200    .8678   30M
     CH   13-14     120-80  -.0805    200-120 -2.0094    500-200   1.0180   35M
     CH   15-16     120-80  -.0856    200-120 -1.9209    500-200   1.1683   40M
     CH   17-18     120-80  -.1022    200-120 -1.8297    500-200   1.3231   45M
     CH   19-20     120-80  -.0934    200-120 -1.7473    500-200   1.4746   50M
     CH   21-22     120-80  -.0989    200-120 -1.6593    500-200   1.6296   55M
     CH   23-24     120-80  -.1084    200-120 -1.5713    500-200   1.7832   60M
     CH   25-26     120-80  -.1167    200-120 -1.4823    500-200   1.9385   65M
     CH   27-28     120-80  -.1223    200-120 -1.3905    500-200   2.0903   70M
     CH   29-30     120-80  -.1292    200-120 -1.3078    500-200   2.2451   75M
     CH   31-32     120-80  -.0916    200-120 -1.2633    500-200   2.4029   80M
     CH   33-34     120-80  -.0530    200-120 -1.2292    500-200   2.5621   85M
     CH   35-36     120-80  -.0606    200-120 -1.1389    500-200   2.7177   90M
     CH   37-38     120-80  -.0719    200-120 -1.0520    500-200   2.8773   95M
     CH   39-40     120-80  -.0827    200-120   -.9669    500-200   3.0363  100M
     CH   41-42     120-80  -.0804    200-120   -.8783    500-200   3.1982  105M
     CH   43-44     120-80  -.0908    200-120   -.7925    500-200   3.3555  110M
     CH   45-46     120-80  -.0925    200-120   -.7087    500-200   3.5149  115M
     CH   47-48     120-80  -.0966    200-120   -.6245    500-200   3.6707  120M
     CH   49-50     120-80  -.1108    200-120   -.5399    500-200   3.8250  125M
     CH   51-52     120-80  -.1173    200-120   -.4569    500-200   3.9774  130M
     CH   53-54     120-80  -.1333    200-120   -.3668    500-200   4.1341  135M
     CH   55-56     120-80  -.1557    200-120   -.2763    500-200   4.2837  140M
     CH   57-58     120-80  -.1507    200-120   -.1971    500-200   4.4364  145M
     CH   59-60     120-80  -.1640    200-120   -.1126    500-200   4.5869  150M

   1972 NOV STATION 19 PA 10**4 AVG 5 DEPTH 24 M SWEEP 30 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-20     120-80    .0971   200-120    .5313    500-200  -.2728     5M
     CH   21-40     120-80    .1941   200-120   1.0619    500-200  -.1256    10M
     CH   41-60     120-80    .2909   200-120   1.5916    500-200  -.0037    15M
     CH   61-80     120-80    .3876   200-120   2.1204    500-200    .2508   20M

1972 NOV STATION 20 PA 10**4 AVG 5 DEPTH 29 M SCAN 36 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-16     120-80    .0968   200-120    .5269    500-200  -.4800     5M
     CH   17-32     120-80    .1935   200-120   1.0531    500-200  -.3715    10M
     CH   33-48     120-80    .2898   200-120   1.5785    500-200  -.2615    15M
     CH   49-64     120-80    .3860   200-120   2.0122    500-200  -.1490    20M
     CH   65-80     120-80    .6402   200-120   1.3910    500-200    .3132   25M
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1972 NOV STATION 24  PA 10**4 AVG 5 DEPTH 123 M SWEEP 160 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 3    120-80   .0600   200-120  1.3697   500-200 -1.3089   5M
     CH   4- 6    120-80  -.1806   200-120  2.7553   500-200 -1.7889  10M
     CH   7- 9    120-80  -.3633   200-120  5.5751   500-200 -1.5620  15M
     CH  10-12    120-80  -.4917   200-120  6.6161   500-200 -1.3918  20M
     CH  13-15    120-80  -.5302   200-120  7.2420   500-200 -1.2306  25M
     CH  16-18    120-80  -.4990   200-120  7.5275   500-200 -1.0708  30M
     CH  19-21    120-80  -.4963   200-120  7.5966   500-200  -.9079  35M
     CH  22-24    120-80  -.4889   200-120  7.6351   500-200  -.7494  40M
     CH  25-27    120-80  -.5172   200-120  7.6840   500-200  -.5924  45M
     CH  28-30    120-80  -.5190   200-120  7.7436   500-200  -.4283  50M
     CH  31-33    120-80  -.5155   200-120  7.7951   500-200  -.2683  55M
     CH  34-36    120-80  -.5195   200-120  7.8473   500-200  -.1130  60M
     CH  37-39    120-80  -.5324   200-120  7.9073   500-200   .0488  65M
     CH  40-42    120-80  -.5255   200-120  7.9632   500-200   .2080  70M
     CH  43-45    120-80  -.5064   200-120  7.9996   500-200   .3605  75M
     CH  46-48    120-80  -.4946   200-120  8.0484   500-200   .5166  80M
     CH  49-51    120-80  -.4713   200-120  8.0908   500-200   .6774  85M
     CH  52-54    120-80  -.4727   200-120  8.1473   500-200   .8325  90M
     CH  55-57    120-80  -.4819   200-120  8.2062   500-200   .9863  95M
     CH  58-60    120-80  -.4956   200-120  8.2667   500-200  1.1424 100M
     CH  61-63    120-80  -.4921   200-120  8.3200   500-200  1.2932 105M
     CH  64-66    120-80  -.4989   200-120  8.3861   500-200  1.4424 110M
     CH  67-69    120-80  -.4926   200-120  8.4398   500-200  1.5949 115M
     CH  70-72    120-80  -.4906   200-120  8.4923   500-200  1.7435 120M


1972 NOV STATION 31  PA 10**4 AVG 5 DEPTH 28 M SCAN 39 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-14    120-80  -.8770   200-120  -.5026   500-200   .1422   5M
     CH  15-28    120-80 -1.3849   200-120  -.6732   500-200   .2622  10M
     CH  29-42    120-80 -1.4034   200-120  -.7541   500-200   .3836  15M
     CH  43-56    120-80 -1.3848   200-120  -.7862   500-200   .5107  20M
     CH  57-70    120-80 -1.4316   200-120  -.7315   500-200   .6427  25M
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1972 NOV STATION 32 PA 10**4 AVG 5 DEPTH 171 M SWEEP 210 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 2     120-80   .2045    200-120 -1.0326    500-200   .2765    5M
     CH   3- 4     120-80   .2400    200-120 -1.2940    500-200   .5358   10M
     CH   5- 6     120-80   .3336    200-120 -1.3231    500-200   .7082   15M
     CH   7- 8     120-80   .3208    200-120 -1.2558    500-200  1.0625   20M
     CH   9-10     120-80   .3190    200-120 -1.1966    500-200  1.3264   25M
     CH  11-12     120-80   .2991    200-120 -1.1319    500-200  1.5908   30M
     CH  13-14     120-80   .2863    200-120 -1.0680    500-200  1.8509   35M
     CH  15-16     120-80   .2727    200-120 -1.0036    500-200  2.1140   40M
     CH  17-18     120-80   .2926    200-120  -.9659    500-200  2.3778   45M
     CH  19-20     120-80   .3045    200-120  -.9169    500-200  2.6501   50M
     CH  21-22     120-80   .3101    200-120  -.8602    500-200  2.9163   55M
     CH  23-24     120-80   .3028    200-120  -.8067    500-200  3.1818   60M
     CH  25-26     120-80   .3999    200-120  -.8459    500-200  3.4502   65M
     CH  27-28     120-80   .3940    200-120  -.7873    500-200  3.7151   70M
     CH  29-30     120-80   .3927    200-120  -.7288    500-200  3.9915   75M
     CH  31-32     120-80   .4105    200-120  -.6973    500-200  4.2642   80M
     CH  33-34     120-80   .4126    200-120  -.6449    500-200  4.5320   85M
     CH  35-36     120-80   .3847    200-120  -.5750    500-200  4.8007   90M
     CH  37-38     120-80   .3766    200-120  -.5308    500-200  5.0671   95M
     CH  39-40     120-80   .3687    200-120  -.4768    500-200  5.3332  100M
     CH  41-42     120-80   .3528    200-120  -.4196    500-200  5.6000  105M
     CH  43-44     120-80   .3365    200-120  -.3549    500-200  5.8652  110M
     CH  45-46     120-80   .3437    200-120  -.3009    500-200  6.1347  115M
     CH  47-48     120-80   .3378    200-120  -.2397    500-200  6.4075  120M
     CH  49-50     120-80   .3260    200-120  -.1760    500-200  6.6800  125M
     CH  51-52     120-80   .3206    200-120  -.1260    500-200  6.9556  130M
     CH  53-54     120-80   .3182    200-120  -.0673    500-200  7.2276  135M
     CH  55-56     120-80   .3288    200-120  -.0064    500-200  7.5013  140M
     CH  57-58     120-80   .3190    200-120   .0310    500-200  7.7763  145M
     CH  59-60     120-80   .3183    200-120   .0833    500-200  8.0509  150M
     CH  61-62     120-80   .2967    200-120   .1459    500-200  8.3287  155M
     CH  63-64     120-80   .2836    200-120   .2009    500-200  8.6042  160M
     CH  65-66     120-80   .2666    200-120   .2613    500-200  8.8827  165M
     CH  67-68     120-80   .2487    200-120   .3240    500-200  9.1579  170M
1972 NOV STATION 34 PA 10**4 AVG 5 DEPTH 110 M SWEEP 135 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 3     120-80   .0951    200-120  -.5886    500-200   .0076    5M
     CH   4- 6     120-80   .1897    200-120 -1.4252    500-200   .1151   10M
     CH   7- 9     120-80   .8193    200-120 -2.8364    500-200   .2057   15M
     CH  10-12     120-80   .4867    200-120 -3.2705    500-200   .3011   20M
     CH  13-15     120-80  -.1501    200-120 -3.4019    500-200   .3967   25M
     CH  16-18     120-80 -1.0107    200-120 -3.3345    500-200   .4942   30M
     CH  19-21     120-80 -1.2204    200-120 -3.2531    500-200   .5912   35M
     CH  22-24     120-80 -1.5758    200-120 -3.1702    500-200   .6871   40M
     CH  25-27     120-80 -1.5875    200-120 -3.0952    500-200   .7809   45M
     CH  28-30     120-80 -1.5314    200-120 -3.0229    500-200   .8740   50M
     CH  31-33     120-80 -1.5321    200-120 -2.9433    500-200   .9668   55M
     CH  34-36     120-80 -1.5099    200-120 -2.8666    500-200  1.0617   60M
     CH  37-39     120-80 -1.5058    200-120 -2.7880    500-200  1.1568   65M
     CH  40-42     120-80 -1.4938    200-120 -2.7068    500-200  1.2492   70M
     CH  43-45     120-80 -1.4866    200-120 -2.6344    500-200  1.3402   75M
     CH  46-48     120-80 -1.4917    200-120 -2.5575    500-200  1.4355   80M
     CH  49-51     120-80 -1.4955    200-120 -2.4621    500-200  1.5290   85M
     CH  52-54     120-80 -1.5113    200-120 -2.4037    500-200  1.6281   90M
     CH  55-57     120-80 -1.5133    200-120 -2.3259    500-200  1.7237   95M
     CH  58-60     120-80 -1.5112    200-120 -2.2568    500-200  1.8223  100M
     CH  61-63     120-80 -1.5202    200-120 -2.1785    500-200  1.9182  105M
     CH  64-66     120-80 -1.5289    200-120 -2.1010    500-200  2.0164  110M
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1972 NOV STATION 35 DEPTH 28 M SCAN 35 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-16      120-80  -.0245   200-120   .5270   500-200  -.5212    5M
     CH   17-32      120-80  -.0494   200-120  1.0532   500-200  -.4092   10M
     CH   33-48      120-80  -.0744   200-120  1.5787   500-200  -.3063   15M
     CH   49-64      120-80  -.0997   200-120  2.1035   500-200  -.2013   20M
     CH   65-80      120-80  -.3085   200-120  2.8112   500-200  -.0680   25M
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1972 NOV STATION 36 PA 10**4 AVE 5 DEPTH 28 M SWEEP 35 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-16      120-80  -.0111   200-120   .5250   500-200  -.4139    5M
     CH   17-32      120-80  -.0241   200-120   .9106   500-200  -.4008   10M
     CH   33-48      120-80  -.0359   200-120  2.6753   500-200  -.3473   15M
     CH   49-64      120-80  -.3657   200-120  3.6360   500-200  -.2813   20M
     CH   65-80      120-80   .5835   200-120  2.5516   500-200  -.0467   25M
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1972 NOV STATION 38 PA 10**4 AVE 5 DEPTH 120 M SWEEP 155 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 3      120-80  -.0264   200-120   .2464   500-200   .0410    5M
     CH    4- 6      120-80   .0219   200-120   .4797   500-200   .1159   10M
     CH    7- 9      120-80  -.0195   200-120   .7245   500-200   .2162   15M
     CH   10-12      120-80  -.0143   200-120   .8916   500-200   .3318   20M
     CH   13-15      120-80  -.0092   200-120  1.0605   500-200   .4535   25M
     CH   16-18      120-80   .0135   200-120  1.2219   500-200   .5786   30M
     CH   19-21      120-80   .0366   200-120  1.3892   500-200   .6603   35M
     CH   22-24      120-80   .0518   200-120  1.5279   500-200   .7304   40M
     CH   25-27      120-80   .0764   200-120  1.6567   500-200   .7907   45M
     CH   28-30      120-80   .1186   200-120  1.7886   500-200   .8469   50M
     CH   31-33      120-80   .1665   200-120  1.9102   500-200   .9079   55M
     CH   34-36      120-80   .2296   200-120  2.0181   500-200   .9562   60M
     CH   37-39      120-80   .2962   200-120  2.1314   500-200  1.0143   65M
     CH   40-42      120-80   .3867   200-120  2.2165   500-200  1.0695   70M
     CH   43-45      120-80   .4466   200-120  2.3379   500-200  1.1251   75M
     CH   46-48      120-80   .5255   200-120  2.4507   500-200  1.1843   80M
     CH   49-51      120-80   .6000   200-120  2.5581   500-200  1.2366   85M
     CH   52-54      120-80   .6753   200-120  2.6915   500-200  1.3001   90M
     CH   55-57      120-80   .7418   200-120  2.8459   500-200  1.3551   95M
     CH   58-60      120-80   .8150   200-120  3.0015   500-200  1.4131  100M
     CH   61-63      120-80   .8761   200-120  3.1642   500-200  1.4734  105M
     CH   64-66      120-80   .9418   200-120  3.3387   500-200  1.5276  110M
     CH   67-69      120-80  1.0156   200-120  3.5156   500-200  1.5695  115M
     CH   70-72      120-80  1.0844   200-120  3.7152   500-200  1.6437  120M
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1972 NOV STATION 40 PA 10**4 AVG 5 DEPTH 175 M SCAN 220 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2     120-80  -.5987   200-120   .2188   500-200  -.0616   5M
     CH    3- 4     120-80  -.6693   200-120   .4561   500-200  -.0964  10M
     CH    5- 6     120-80  -.7048   200-120   .6851   500-200  -.0960  15M
     CH    7- 8     120-80  -.6924   200-120   .8765   500-200  -.0791  20M
     CH    9-10     120-80  -.4836   200-120   .8769   500-200  -.0616  25M
     CH   11-12     120-80  -.4349   200-120  1.0591   500-200  -.0752  30M
     CH   13-14     120-80  -.3662   200-120  1.2135   500-200  -.1155  35M
     CH   15-16     120-80  -.3015   200-120  1.3674   500-200  -.1648  40M
     CH   17-18     120-80  -.2343   200-120  1.5255   500-200  -.2151  45M
     CH   19-20     120-80  -.1776   200-120  1.6896   500-200  -.2721  50M
     CH   21-22     120-80  -.1291   200-120  1.8754   500-200  -.3235  55M
     CH   23-24     120-80  -.0843   200-120  2.0920   500-200  -.3745  60M
     CH   25-26     120-80  -.0225   200-120  2.3183   500-200  -.4290  65M
     CH   27-28     120-80   .0284   200-120  2.5455   500-200  -.4804  70M
     CH   29-30     120-80   .1058   200-120  2.7679   500-200  -.5297  75M
     CH   31-32     120-80   .1563   200-120  3.0191   500-200  -.5837  80M
     CH   33-34     120-80   .2099   200-120  3.2560   500-200  -.6320  85M
     CH   35-36     120-80   .2548   200-120  3.5154   500-200  -.6866  90M
     CH   37-38     120-80   .3305   200-120  3.7532   500-200  -.7386  95M
     CH   39-40     120-80   .3855   200-120  3.9907   500-200  -.7882 100M
     CH   41-42     120-80   .4241   200-120  4.2404   500-200  -.8420 105M
     CH   43-44     120-80   .4950   200-120  4.4807   500-200  -.8963 110M
     CH   45-46     120-80   .5333   200-120  4.7262   500-200  -.9475 115M
     CH   47-48     120-80   .5830   200-120  4.9613   500-200 -1.0053 120M
     CH   49-50     120-80   .6448   200-120  5.2028   500-200 -1.0611 125M
     CH   51-52     120-80   .7027   200-120  5.4417   500-200 -1.1145 130M
     CH   53-54     120-80   .7469   200-120  5.6826   500-200 -1.1719 135M
     CH   55-56     120-80   .8059   200-120  5.9248   500-200 -1.2272 140M
     CH   57-58     120-80   .8517   200-120  6.1588   500-200 -1.2828 145M
     CH   59-60     120-80   .9100   200-120  6.3933   500-200 -1.3440 150M
     CH   61-62     120-80   .9461   200-120  6.6417   500-200 -1.3990 155M
     CH   63-64     120-80  1.0051   200-120  6.8822   500-200 -1.4565 160M
     CH   65-66     120-80  1.0520   200-120  7.1263   500-200 -1.5177 165M
     CH   67-68     120-80  1.1126   200-120  7.3683   500-200 -1.5725 170M
     CH   69-70     120-80  1.1581   200-120  7.6135   500-200 -1.6312 175M

1972 NOV STATION 41  PA 10**4 AVG 5 DEPTH 35 M SCAN 46 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-11     120-80   .0259   200-120   .0144   500-200   .1390   5M
     CH   12-22     120-80   .0699   200-120   .0504   500-200   .2796  10M
     CH   23-33     120-80   .0634   200-120   .1169   500-200   .4172  15M
     CH   34-44     120-80   .0597   200-120   .1785   500-200   .5554  20M
     CH   45-55     120-80   .0976   200-120   .2361   500-200   .6946  25M
     CH   56-66     120-80   .1170   200-120   .2931   500-200   .8350  30M
     CH   67-77     120-80   .1178   200-120   .3404   500-200  1.0808  35M

1972 NOV STATION 42 PA 10**4 AVG 5 DEPTH 35 M SCAN 45 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-11     120-80   .0963   200-120   .5172   500-200   .5181   5M
     CH   12-22     120-80   .1923   200-120  -.1722   500-200   .7328  10M
     CH   23-33     120-80   .2885   200-120  -.6570   500-200   .9375  15M
     CH   34-44     120-80   .3844   200-120 -1.6203   500-200  1.1432  20M
     CH   45-55     120-80   .4814   200-120  -.5276   500-200  1.3466  25M
     CH   56-66     120-80   .5775   200-120  -.1307   500-200  1.5483  30M
     CH   67-77     120-80   .1466   200-120   .1788   500-200  1.8545  35M
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1972 NOV STATION 44  PA 10**4 AVG 5 DEPTH 190 M SCAN 250 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2      120-80  -.4689   200-120    .3845    500-200  1.2568    5M
     CH    3- 4      120-80  -.6043   200-120    .6414    500-200  1.7988   10M
     CH    5- 6      120-80  -.5669   200-120    .6503    500-200  2.3788   15M
     CH    7- 8      120-80  -.5227   200-120    .9284    500-200  2.9022   20M
     CH    9-10      120-80  -.4337   200-120   1.0848    500-200  3.4096   25M
     CH   11-12      120-80  -.2748   200-120   1.2083    500-200  3.7804   30M
     CH   13-14      120-80  -.1951   200-120   1.4019    500-200  4.1070   35M
     CH   15-16      120-80  -.1328   200-120   1.6029    500-200  4.4665   40M
     CH   17-18      120-80  -.0640   200-120   1.7961    500-200  4.6788   45M
     CH   19-20      120-80  -.0090   200-120   2.0352    500-200  4.7820   50M
     CH   21-22      120-80   .0510   200-120   2.2970    500-200  4.7760   55M
     CH   23-24      120-80   .1067   200-120   2.5626    500-200  4.6641   60M
     CH   25-26      120-80   .1469   200-120   2.8425    500-200  4.5545   65M
     CH   27-28      120-80   .2003   200-120   3.1240    500-200  4.4583   70M
     CH   29-30      120-80   .2520   200-120   3.4107    500-200  4.3418   75M
     CH   31-32      120-80   .2889   200-120   3.7008    500-200  4.2612   80M
     CH   33-34      120-80   .3115   200-120   3.9959    500-200  4.1618   85M
     CH   35-36      120-80   .3450   200-120   4.2824    500-200  4.0603   90M
     CH   37-38      120-80   .3807   200-120   4.5751    500-200  3.9758   95M
     CH   39-40      120-80   .4277   200-120   4.8601    500-200  3.8853  100M
     CH   41-42      120-80   .4741   200-120   5.1539    500-200  3.8000  105M
     CH   43-44      120-80   .4964   200-120   5.4523    500-200  3.7097  110M
     CH   45-46      120-80   .5165   200-120   5.7572    500-200  3.6280  115M
     CH   47-48      120-80   .5516   200-120   6.0366    500-200  3.5416  120M
     CH   49-50      120-80   .5858   200-120   6.3156    500-200  3.4565  125M
     CH   51-52      120-80   .6272   200-120   6.5956    500-200  3.3732  130M
     CH   53-54      120-80   .6671   200-120   6.8808    500-200  3.2888  135M
     CH   55-56      120-80   .7165   200-120   7.1578    500-200  3.2037  140M
     CH   57-58      120-80   .7640   200-120   7.4325    500-200  3.1208  145M
     CH   59-60      120-80   .7858   200-120   7.7099    500-200  3.0399  150M
     CH   61-62      120-80   .8019   200-120   7.9946    500-200  2.9535  155M
     CH   63-64      120-80   .8329   200-120   8.2685    500-200  2.8681  160M
     CH   65-66      120-80   .8645   200-120   8.5438    500-200  2.7831  165M
     CH   67-68      120-80   .9034   200-120   8.8149    500-200  2.6989  170M
     CH   69-70      120-80   .9428   200-120   9.0895    500-200  2.6147  175M
     CH   71-72      120-80   .9799   200-120   9.3682    500-200  2.5306  180M
     CH   73-74      120-80  1.0205   200-120   9.6394    500-200  2.4446  185M
     CH   75-76      120-80  1.0718   200-120   9.9130    500-200  2.2697  190M
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1972NOV STATION 46 PA 10**4 AVE 5 DEPTH 150 M DEPTH 200 M
   MEAN VALUE OF PROFILES OVER 5M INTERVALS

   CH    1- 2     120-80  -.0263   200-120  -.5117   500-200  -.1157    5M
   CH    3- 4     120-80   .2989   200-120 -1.1983   500-200  -.1011   10M
   CH    5- 6     120-80   .3031   200-120 -1.1829   500-200  -.0847   15M
   CH    7- 8     120-80   .3327   200-120  -.9278   500-200  -.0435   20M
   CH    9-10     120-80   .3860   200-120  -.6870   500-200   .0044   25M
   CH   11-12     120-80   .4245   200-120  -.4590   500-200   .0587   30M
   CH   13-14     120-80   .4464   200-120  -.2248   500-200   .0936   35M
   CH   15-16     120-80   .4743   200-120  -.0070   500-200   .1004   40M
   CH   17-18     120-80   .5119   200-120   .2043   500-200   .0932   45M
   CH   19-20     120-80   .5365   200-120   .4138   500-200   .0875   50M
   CH   21-22     120-80   .5691   200-120   .6263   500-200   .0778   55M
   CH   23-24     120-80   .6082   200-120   .8264   500-200   .0663   60M
   CH   25-26     120-80   .6357   200-120  1.0392   500-200   .0538   65M
   CH   27-28     120-80   .6716   200-120  1.2770   500-200   .0386   70M
   CH   29-30     120-80   .6987   200-120  1.5282   500-200   .0298   75M
   CH   31-32     120-80   .7198   200-120  1.7870   500-200   .0141   80M
   CH   33-34     120-80   .7333   200-120  2.0538   500-200   .0086   85M
   CH   35-36     120-80   .7580   200-120  2.3214   500-200  -.0049   90M
   CH   37-38     120-80   .7793   200-120  2.6017   500-200  -.0136   95M
   CH   39-40     120-80   .8136   200-120  2.8763   500-200  -.0264  100M
   CH   41-42     120-80   .8322   200-120  3.1473   500-200  -.0395  105M
   CH   43-44     120-80   .8488   200-120  3.4214   500-200  -.0475  110M
   CH   45-46     120-80   .8639   200-120  3.6933   500-200  -.0602  115M
   CH   47-48     120-80   .8889   200-120  3.9694   500-200  -.0684  120M
   CH   49-50     120-80   .9304   200-120  4.2394   500-200  -.0787  125M
   CH   51-52     120-80   .9684   200-120  4.5132   500-200  -.0855  130M
   CH   53-54     120-80   .9924   200-120  4.7822   500-200  -.0960  135M
   CH   55-56     120-80  1.0241   200-120  5.0491   500-200  -.1044  140M
   CH   57-58     120-80  1.0531   200-120  5.3236   500-200  -.1122  145M
   CH   59-60     120-80  1.0832   200-120  5.5870   500-200  -.1264  150M

1972NOV STATION 48 PA 10**4 AVE 5 DEPTH 26  SWEEP 39 M
   MEAN VALUE OF PROFILES OVER 5M INTERVALS

   CH    1-13     120-80  -.0467   200-120   .5266   500-200  -.3348    5M
   CH   14-26     120-80  -.0938   200-120  1.0524   500-200  -.3424   10M
   CH   27-39     120-80  -.1411   200-120  1.5774   500-200  -.2684   15M
   CH   40-52     120-80  -.1885   200-120  1.6722   500-200  -.1745   20M
   CH   53-65     120-80  -.2362   200-120  1.4207   500-200  -.0783   25M

1972 NOV STATION 49 PA 10**4 AVE 5 DEPTH 30 M SWEEP 40 M
   MEAN VALUE OF PROFILES OVER 5M INTERVALS

   CH    1-12     120-80  -.8646   200-120   .5281   500-200  -.0002    5M
   CH   13-24     120-80 -1.7294   200-120  2.1463   500-200   .2924   10M
   CH   25-36     120-80 -2.5943   200-120  3.0383   500-200   .5513   15M
   CH   37-48     120-80 -3.4593   200-120  3.4315   500-200   .8099   20M
   CH   49-60     120-80 -4.3245   200-120  3.2220   500-200  1.0711   25M
   CH   61-72     120-80 -5.1897   200-120  2.6471   500-200  1.3335   30M
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1978ØV STATION 45 PA 10**4 AVG 5 DEPTH 183 M SWEEP 250 M
  MEAN VALUE OF PRØFILES OVER 5M INTERVALS

CH    1- 2     120-80   -.0197   200-120   -.3466   500-200   -.3163    5M
CH    3- 4     120-80    .6051   200-120   -.8062   500-200   -.3597   10M
CH    5- 6     120-80    .7312   200-120   -.6050   500-200   -.3716   15M
CH    7- 8     120-80    .7988   200-120   -.3798   500-200   -.3612   20M
CH    9-10     120-80    .9454   200-120   -.2368   500-200   -.3676   25M
CH   11-12     120-80   1.0058   200-120   -.0041   500-200   -.4252   30M
CH   13-14     120-80   1.0692   200-120    .2044   500-200   -.4999   35M
CH   15-16     120-80   1.1677   200-120    .4027   500-200   -.5797   40M
CH   17-18     120-80   1.2478   200-120    .6107   500-200   -.6613   45M
CH   19-20     120-80   1.2925   200-120    .8767   500-200   -.7468   50M
CH   21-22     120-80   1.3448   200-120   1.1632   500-200   -.8324   55M
CH   23-24     120-80   1.3983   200-120   1.4570   500-200   -.9158   60M
CH   25-26     120-80   1.4597   200-120   1.7649   500-200   -.9977   65M
CH   27-28     120-80   1.5053   200-120   2.0678   500-200  -1.0837   70M
CH   29-30     120-80   1.5638   200-120   2.3864   500-200  -1.1645   75M
CH   31-32     120-80   1.6074   200-120   2.7072   500-200  -1.1384   80M
CH   33-34     120-80   1.6608   200-120   3.0293   500-200  -1.1770   85M
CH   35-36     120-80   1.7098   200-120   3.3492   500-200  -1.2591   90M
CH   37-38     120-80   1.7560   200-120   3.6735   500-200  -1.3409   95M
CH   39-40     120-80   1.7977   200-120   3.9978   500-200  -1.4262  100M
CH   41-42     120-80   1.8402   200-120   4.3151   500-200  -1.5133  105M
CH   43-44     120-80   1.8963   200-120   4.6366   500-200  -1.6125  110M
CH   45-46     120-80   1.9452   200-120   4.9541   500-200  -1.6571  115M
CH   47-48     120-80   1.9832   200-120   5.2792   500-200  -1.7175  120M
CH   49-50     120-80   2.0360   200-120   5.5960   500-200  -1.8002  125M
CH   51-52     120-80   2.0817   200-120   5.9097   500-200  -1.8781  130M
CH   53-54     120-80   2.1207   200-120   6.2299   500-200  -1.9563  135M
CH   55-56     120-80   2.1596   200-120   6.5492   500-200  -2.0360  140M
CH   57-58     120-80   2.2018   200-120   6.8614   500-200  -2.1153  145M
CH   59-60     120-80   2.2465   200-120   7.1758   500-200  -2.1918  150M
CH   61-62     120-80   2.3013   200-120   7.4902   500-200  -2.2666  155M
CH   63-64     120-80   2.3483   200-120   7.8028   500-200  -2.3454  160M
CH   65-66     120-80   2.3845   200-120   8.1205   500-200  -2.4245  165M
CH   67-68     120-80   2.4424   200-120   8.4076   500-200  -2.5007  170M
CH   69-70     120-80   2.4930   200-120   8.7784   500-200  -2.5791  175M
CH   71-72     120-80   2.5308   200-120   9.0930   500-200  -2.6597  180M
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1972 NOV STATION 52 PA 10**4 AVE 5 DEPTH 65 M  SWEEP 77 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 6      120-80    .0951   200-120  1.3956   500-200  -.3514   5M
     CH    7-12      120-80    .1902   200-120  1.3932   500-200  -.2014  10M
     CH   13-18      120-80    .2849   200-120   .8149   500-200  -.0329  15M
     CH   19-24      120-80    .3797   200-120  -.0473   500-200   .1343  20M
     CH   25-30      120-80    .4742   200-120  -.8396   500-200   .2981  25M
     CH   31-36      120-80    .5689   200-120 -1.6616   500-200   .4623  30M
     CH   37-42      120-80    .6633   200-120 -2.5248   500-200   .6243  35M
     CH   43-48      120-80    .4465   200-120 -3.0351   500-200   .7912  40M
     CH   49-54      120-80    .0798   200-120 -3.4153   500-200   .9570  45M
     CH   55-60      120-80 -1.1490   200-120 -3.3653   500-200  1.1202  50M
     CH   61-66      120-80    .1034   200-120 -4.6985   500-200  1.2869  55M
     CH   67-72      120-80    .7206   200-120 -5.2441   500-200  1.4498  60M
     CH   73-78      120-80    .8036   200-120 -5.2349   500-200  1.6135  65M
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1972 NOV STATION 56 PA 10**4 AVG 5 DEPTH 154 M SWEEP 200 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2      120-80    .0939   200-120   .0468   500-200  -.2235    5M
     CH    3- 4      120-80   1.1171   200-120 -1.4694   500-200   .0152   10M
     CH    5- 6      120-80   2.1985   200-120 -2.5269   500-200   .3569   15M
     CH    7- 8      120-80   1.6340   200-120 -2.5169   500-200   .7043   20M
     CH    9-10      120-80   1.6300   200-120 -2.4452   500-200  1.0489   25M
     CH   11-12      120-80   1.6087   200-120 -2.3709   500-200  1.3968   30M
     CH   13-14      120-80   1.5879   200-120 -2.3101   500-200  1.7409   35M
     CH   15-16      120-80   1.5708   200-120 -2.2492   500-200  2.0865   40M
     CH   17-18      120-80   1.5245   200-120 -2.1775   500-200  2.4315   45M
     CH   19-20      120-80   1.5017   200-120 -2.1233   500-200  2.7733   50M
     CH   21-22      120-80   1.4753   200-120 -2.0672   500-200  3.1225   55M
     CH   23-24      120-80   1.4489   200-120 -2.0093   500-200  3.4646   60M
     CH   25-26      120-80   1.4180   200-120 -1.9496   500-200  3.8147   65M
     CH   27-28      120-80   1.3829   200-120 -1.8825   500-200  4.1588   70M
     CH   29-30      120-80   1.3589   200-120 -1.8273   500-200  4.4993   75M
     CH   31-32      120-80   1.3353   200-120 -1.7728   500-200  4.8424   80M
     CH   33-34      120-80   1.3048   200-120 -1.7153   500-200  5.1873   85M
     CH   35-36      120-80   1.2802   200-120 -1.6495   500-200  5.5315   90M
     CH   37-38      120-80   1.2529   200-120 -1.5858   500-200  5.8736   95M
     CH   39-40      120-80   1.2219   200-120 -1.5291   500-200  6.2181  100M
     CH   41-42      120-80   1.1868   200-120 -1.4731   500-200  6.5666  105M
     CH   43-44      120-80   1.1693   200-120 -1.4350   500-200  6.9133  110M
     CH   45-46      120-80   1.1906   200-120 -1.4488   500-200  7.2590  115M
     CH   47-48      120-80   1.1653   200-120 -1.3957   500-200  7.5982  120M
     CH   49-50      120-80   1.1476   200-120 -1.3487   500-200  7.9423  125M
     CH   51-52      120-80   1.0948   200-120 -1.2837   500-200  8.2856  130M
     CH   53-54      120-80   1.0678   200-120 -1.2339   500-200  8.6321  135M
     CH   55-56      120-80   1.0345   200-120 -1.1753   500-200  8.9760  140M
     CH   57-58      120-80   1.0160   200-120 -1.1256   500-200  9.3195  145M
     CH   59-60      120-80    .9767   200-120 -1.0552   500-200  9.6630  150M
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1972 NOV STATION 59 PA 10**4 AVG 5 DEPTH 40 M SWEEP 50 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-10      120-80   .0961   200-120   .5244   500-200  -.0644    5M
     CH   11-20      120-80   .1918   200-120  1.0492   500-200  -.0936   10M
     CH   21-30      120-80   .2874   200-120   .2109   500-200  -.0071   15M
     CH   31-40      120-80   .3829   200-120  1.7536   500-200   .0797   20M
     CH   41-50      120-80   .4783   200-120  2.7067   500-200   .1650   25M
     CH   51-60      120-80   .5737   200-120  3.0188   500-200   .2545   30M
     CH   61-70      120-80   .6689   200-120  2.8647   500-200   .3429   35M
     CH   71-80      120-80   .7640   200-120  2.4727   500-200   .4299   40M

1972 NOV STATION 60 PA 10**4 AVE 5 DEPTH 20 M SWEEP 24 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-20      120-80   .0973   200-120   .5339   500-200  -.0895    5M
     CH   21-40      120-80  -.1488   200-120  1.4328   500-200  -.0258   10M
     CH   41-60      120-80   .5700   200-120   .0961   500-200   .0566   15M
     CH   61-80      120-80   .7586   200-120   .3200   500-200   .1398   20M

1972 NOV STATION 62  PA 10**4 AVG 5 DEPTH 185 M SWEEP 210 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2      120-80  -.4897   200-120   .0048   500-200   .1283    5M
     CH    3- 4      120-80  -.4700   200-120   .0667   500-200   .2527   10M
     CH    5- 6      120-80  -.4722   200-120   .1263   500-200   .3770   15M
     CH    7- 8      120-80  -.4596   200-120   .1919   500-200   .5021   20M
     CH    9-10      120-80  -.4633   200-120   .2693   500-200   .6264   25M
     CH   11-12      120-80  -.4556   200-120   .3309   500-200   .7502   30M
     CH   13-14      120-80  -.4344   200-120   .3957   500-200   .8722   35M
     CH   15-16      120-80  -.4241   200-120   .4710   500-200   .9965   40M
     CH   17-18      120-80  -.4117   200-120   .5476   500-200  1.1234   45M
     CH   19-20      120-80  -.3985   200-120   .6219   500-200  1.2473   50M
     CH   21-22      120-80  -.3871   200-120   .6944   500-200  1.3742   55M
     CH   23-24      120-80  -.3751   200-120   .7586   500-200  1.4953   60M
     CH   25-26      120-80  -.3639   200-120   .8395   500-200  1.6108   65M
     CH   27-28      120-80  -.3467   200-120   .9075   500-200  1.7325   70M
     CH   29-30      120-80  -.3435   200-120   .9833   500-200  1.8469   75M
     CH   31-32      120-80  -.3656   200-120  1.0591   500-200  1.9654   80M
     CH   33-34      120-80  -.3471   200-120  1.1154   500-200  2.0854   85M
     CH   35-36      120-80  -.3464   200-120  1.1915   500-200  2.2023   90M
     CH   37-38      120-80  -.3115   200-120  1.2599   500-200  2.3204   95M
     CH   39-40      120-80  -.3236   200-120  1.3506   500-200  2.4406  100M
     CH   41-42      120-80  -.3295   200-120  1.4288   500-200  2.5611  105M
     CH   43-44      120-80  -.3271   200-120  1.5038   500-200  2.6806  110M
     CH   45-46      120-80  -.3104   200-120  1.5712   500-200  2.7991  115M
     CH   47-48      120-80  -.2924   200-120  1.6421   500-200  2.9188  120M
     CH   49-50      120-80  -.2889   200-120  1.7250   500-200  3.0354  125M
     CH   51-52      120-80  -.2573   200-120  1.7868   500-200  3.1550  130M
     CH   53-54      120-80  -.2380   200-120  1.8615   500-200  3.2751  135M
     CH   55-56      120-80  -.2211   200-120  1.9298   500-200  3.3939  140M
     CH   57-58      120-80  -.2018   200-120  1.9969   500-200  3.5169  145M
     CH   59-60      120-80  -.2060   200-120  2.0683   500-200  3.6367  150M
     CH   61-62      120-80  -.1918   200-120  2.1453   500-200  3.7589  155M
     CH   63-64      120-80  -.1874   200-120  2.2239   500-200  3.8807  160M
     CH   65-66      120-80  -.1759   200-120  2.2924   500-200  4.0047  165M
     CH   67-68      120-80  -.1615   200-120  2.3563   500-200  4.1297  170M
     CH   69-70      120-80  -.1455   200-120  2.4198   500-200  4.2519  175M
     CH   71-72      120-80  -.1312   200-120  2.4943   500-200  4.3721  180M
     CH   73-74      120-80  -.1288   200-120  2.5738   500-200  4.4952  185M
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1972 NOV STATION 64 PA 10**4 AVE 5 DEPTH 114 M SWEEP 130 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS


     CH    1- 3     120-80    .0948    200-120    .4909    500-200   -.5811    5M
     CH    4- 6     120-80    .1894    200-120    .0647    500-200   -.5008   10M
     CH    7- 9     120-80    .2763    200-120   -.4583    500-200   -.3443   15M
     CH   10-12     120-80   -.9471    200-120   -.4829    500-200   -.1926   20M
     CH   13-15     120-80    .0702    200-120  -1.8453    500-200   -.0411   25M
     CH   16-18     120-80   1.2298    200-120  -3.1107    500-200    .1109   30M
     CH   19-21     120-80   2.0867    200-120  -3.8655    500-200    .2624   35M
     CH   22-24     120-80   2.2817    200-120  -4.0597    500-200    .4159   40M
     CH   25-27     120-80   2.2605    200-120  -3.9865    500-200    .5707   45M
     CH   28-30     120-80   2.2642    200-120  -3.9311    500-200    .7210   50M
     CH   31-33     120-80   2.2528    200-120  -3.8805    500-200    .8742   55M
     CH   34-36     120-80   2.2424    200-120  -3.8276    500-200   1.0305   60M
     CH   37-39     120-80   2.2493    200-120  -3.7705    500-200   1.1822   65M
     CH   40-42     120-80   2.2479    200-120  -3.7141    500-200   1.3332   70M
     CH   43-45     120-80   2.2231    200-120  -3.6540    500-200   1.4867   75M
     CH   46-48     120-80   2.2318    200-120  -3.6121    500-200   1.6414   80M
     CH   49-51     120-80   2.2231    200-120  -3.5557    500-200   1.7916   85M
     CH   52-54     120-80   2.2174    200-120  -3.4997    500-200   1.9452   90M
     CH   55-57     120-80   2.2182    200-120  -3.4481    500-200   2.0978   95M
     CH   58-60     120-80   2.2138    200-120  -3.3935    500-200   2.2489  100M
     CH   61-63     120-80   2.2165    200-120  -3.3417    500-200   2.4009  105M
1972 CH   64-66     120-80   2.2988    200-120  -3.3785    500-200   2.5506  110M
     NOV STATION 66 PA 10**4 AVE 5 DEPTH 12 M  SWEEP 29 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS


     CH    1-20     120-80    .0704    200-120   -.2911    500-200   -.0181    5M
     CH   21-40     120-80   -.0065    200-120   -.7533    500-200    .0384   10M
1972 NOV STATION 69 PA 10**4 AVE 5 DEPTH 152 SWEEP 190 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS


     CH    1- 2     120-80  -1.2321    200-120    .2080    500-200    .0478    5M
     CH    3- 4     120-80  -1.4479    200-120    .3609    500-200    .1173   10M
     CH    5- 6     120-80  -1.4394    200-120    .5125    500-200    .1926   15M
     CH    7- 8     120-80  -1.4131    200-120    .6672    500-200    .2739   20M
     CH    9-10     120-80  -1.3968    200-120    .8136    500-200    .3506   25M
     CH   11-12     120-80  -1.3949    200-120    .9617    500-200    .4156   30M
     CH   13-14     120-80  -1.3941    200-120   1.1032    500-200    .4753   35M
     CH   15-16     120-80  -1.3921    200-120   1.2422    500-200    .5328   40M
     CH   17-18     120-80  -1.3855    200-120   1.3841    500-200    .5920   45M
     CH   19-20     120-80  -1.3801    200-120   1.5410    500-200    .6491   50M
     CH   21-22     120-80  -1.3736    200-120   1.6954    500-200    .7046   55M
     CH   23-24     120-80  -1.3712    200-120   1.8597    500-200    .7599   60M
     CH   25-26     120-80  -1.3772    200-120   2.0288    500-200    .8165   65M
     CH   27-28     120-80  -1.3625    200-120   2.1961    500-200    .8722   70M
     CH   29-30     120-80  -1.3531    200-120   2.3621    500-200    .9274   75M
     CH   31-32     120-80  -1.3540    200-120   2.5323    500-200    .9845   80M
     CH   33-34     120-80  -1.3469    200-120   2.6941    500-200   1.0379   85M
     CH   35-36     120-80  -1.3421    200-120   2.8635    500-200   1.0939   90M
     CH   37-38     120-80  -1.3337    200-120   3.0319    500-200   1.1489   95M
     CH   39-40     120-80  -1.3301    200-120   3.1978    500-200   1.2083  100M
     CH   41-42     120-80  -1.3380    200-120   3.3688    500-200   1.2646  105M
     CH   43-44     120-80  -1.3286    200-120   3.5362    500-200   1.3201  110M
     CH   45-46     120-80  -1.3331    200-120   3.7097    500-200   1.3762  115M
     CH   47-48     120-80  -1.3312    200-120   3.8809    500-200   1.4326  120M
     CH   49-50     120-80  -1.3286    200-120   4.0490    500-200   1.4896  125M
     CH   51-52     120-80  -1.3152    200-120   4.2116    500-200   1.5421  130M
     CH   53-54     120-80  -1.2798    200-120   4.3439    500-200   1.5970  135M
     CH   55-56     120-80  -1.2309    200-120   4.4661    500-200   1.6486  140M
     CH   57-58     120-80  -1.2236    200-120   4.6216    500-200   1.7026  145M
     CH   59-60     120-80  -1.2131    200-120   4.7847    500-200   1.7560  150M
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1972 NOV STATION 71 PA 10**4 AVG 5 DEPTH 204 M SWEEP 240 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2      120-80    .5958    200-120   -.6335    500-200    .0989    5M
     CH    3- 4      120-80    .6703    200-120   -.7139    500-200    .1909   10M
     CH    5- 6      120-80    .7419    200-120   -.7117    500-200    .2845   15M
     CH    7- 8      120-80    .7486    200-120   -.6399    500-200    .3817   20M
     CH    9-10      120-80    .7532    200-120   -.5769    500-200    .4776   25M
     CH   11-12      120-80    .7598    200-120   -.5124    500-200    .5737   30M
     CH   13-14      120-60    .7713    200-120   -.4552    500-200    .6693   35M
     CH   15-16      120-80    .7703    200-120   -.3893    500-200    .7677   40M
     CH   17-18      120-80    .7655    200-120   -.3226    500-200    .8753   45M
     CH   19-20      120-80    .7650    200-120   -.2582    500-200    .9718   50M
     CH   21-22      120-80    .7654    200-120   -.1909    500-200   1.0683   55M
     CH   23-24      120-80    .7618    200-120   -.1195    500-200   1.1683   60M
     CH   25-26      120-80    .7631    200-120   -.0558    500-200   1.2676   65M
     CH   27-28      120-80    .7519    200-120    .0102    500-200   1.3635   70M
     CH   29-30      120-80    .7357    200-120    .0821    500-200   1.4624   75M
     CH   31-32      120-80    .7321    200-120    .1465    500-200   1.5608   80M
     CH   33-34      120-80    .7207    200-120    .2046    500-200   1.6610   85M
     CH   35-36      120-80    .7201    200-120    .2544    500-200   1.7613   90M
     CH   37-38      120-80    .7182    200-120    .3228    500-200   1.8605   95M
     CH   39-40      120-80    .7122    200-120    .3818    500-200   1.9588  100M
     CH   41-42      120-80    .7110    200-120    .4444    500-200   2.0575  105M
     CH   43-44      120-80    .7055    200-120    .5052    500-200   2.1564  110M
     CH   45-46      120-80    .7022    200-120    .5655    500-200   2.2548  115M
     CH   47-48      120-80    .6927    200-120    .6346    500-200   2.3533  120M
     CH   49-50      120-80    .6769    200-120    .7028    500-200   2.4554  125M
     CH   51-52      120-80    .6731    200-120    .7700    500-200   2.5604  130M
     CH   53-54      120-80    .6713    200-120    .8344    500-200   2.6627  135M
     CH   55-56      120-80    .6795    200-120    .8955    500-200   2.7634  140M
     CH   57-58      120-80    .6761    200-120    .9573    500-200   2.8647  145M
     CH   59-60      120-80    .6753    200-120   1.0138    500-200   2.9646  150M
     CH   61-62      120-80    .6701    200-120   1.0721    500-200   3.0672  155M
     CH   63-64      120-80    .6693    200-120   1.1332    500-200   3.1704  160M
     CH   65-66      120-80    .6679    200-120   1.1912    500-200   3.2730  165M
     CH   67-68      120-80    .6731    200-120   1.2469    500-200   3.3770  170M
     CH   69-70      120-80    .6579    200-120   1.3063    500-200   3.4813  175M
     CH   71-72      120-80    .6506    200-120   1.3677    500-200   3.5835  180M
     CH   73-74      120-80    .6353    200-120   1.4331    500-200   3.6864  185M
     CH   75-76      120-80    .6299    200-120   1.4917    500-200   3.7894  190M
     CH   77-78      120-80    .6270    200-120   1.5484    500-200   3.8942  195M
     CH   79-80      120-80    .6191    200-120   1.6111    500-200   3.9949  200M

1972 NOV STATION 72 PA 10**4 AVE 5 DEPTH 31 M SWEEP 39 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-13      120-80    .0960    200-120   -.4659    500-200   -.0625    5M
     CH   14-26      120-80    .1918    200-120   -.9213    500-200    .0548   10M
     CH   27-39      120-80    .2875    200-120  -1.4382    500-200    .1568   15M
     CH   40-52      120-80   -.2095    200-120  -2.0314    500-200    .2622   20M
     CH   53-65      120-80   -.2941    200-120  -2.7568    500-200    .3646   25M
     CH   66-78      120-80   -.4875    200-120  -3.4899    500-200    .4735   30M
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1972 NOV STATION 73 PA 10**4 AVG 5 DEPTH 17 M SWEEP 27 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-20       120-80  -.7611    200-120  1.3980    500-200   -.6087    5M
     CH  21-40       120-80  -.6103    200-120  1.4903    500-200   -.5652   10M
     CH  41-60       120-80 -1.1354    200-120  2.3782    500-200   -.5128   15M


1972 NOV STATION 75 PA 10**4 AVG 5 DEPTH 233 M SWEEP 270 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 1       120-80    .0631   200-120    .1422   500-200    .2774   5M
     CH   2- 2       120-80    .1224   200-120    .2848   500-200    .5674  10M
     CH   3- 3       120-80    .3161   200-120    .2621   500-200    .8661  15M
     CH   4- 4       120-80    .3323   200-120    .4018   500-200   1.1718  20M
     CH   5- 5       120-80    .3522   200-120    .5534   500-200   1.4760  25M
     CH   6- 6       120-80    .3792   200-120    .7095   500-200   1.7706  30M
     CH   7- 7       120-80    .3965   200-120    .8773   500-200   2.0610  35M
     CH   8- 8       120-80    .4253   200-120   1.0425   500-200   2.3431  40M
     CH   9- 9       120-80    .4543   200-120   1.2085   500-200   2.6257  45M
     CH  10-10       120-80    .4714   200-120   1.3824   500-200   2.9108  50M
     CH  11-11       120-80    .4785   200-120   1.5636   500-200   3.1917  55M
     CH  12-12       120-80    .4938   200-120   1.7441   500-200   3.4710  60M
     CH  13-13       120-80    .5090   200-120   1.9191   500-200   3.7561  65M
     CH  14-14       120-80    .5151   200-120   2.1086   500-200   4.0365  70M
     CH  15-15       120-80    .5273   200-120   2.2865   500-200   4.3200  75M
     CH  16-16       120-80    .5407   200-120   2.4628   500-200   4.6042  80M
     CH  17-17       120-80    .5658   200-120   2.6330   500-200   4.8910  85M
     CH  18-18       120-80    .5768   200-120   2.8155   500-200   5.1738  90M
     CH  19-19       120-80    .5953   200-120   2.9870   500-200   5.4574  95M
     CH  20-20       120-80    .6124   200-120   3.1608   500-200   5.7352 100M
     CH  21-21       120-80    .6353   200-120   3.3373   500-200   6.0149 105M
     CH  22-22       120-80    .6586   200-120   3.5090   500-200   6.3007 110M
     CH  23-23       120-80    .6750   200-120   3.6807   500-200   6.5813 115M
     CH  24-24       120-80    .6851   200-120   3.8553   500-200   6.8679 120M
     CH  25-25       120-80    .6948   200-120   4.0295   500-200   7.1465 125M
     CH  26-26       120-80    .7103   200-120   4.2010   500-200   7.4310 130M
     CH  27-27       120-80    .7259   200-120   4.3748   500-200   7.7104 135M
     CH  28-28       120-80    .7415   200-120   4.5488   500-200   7.9997 140M
     CH  29-29       120-80    .7590   200-120   4.7212   500-200   8.2830 145M
     CH  30-30       120-80    .7696   200-120   4.8966   500-200   8.5671 150M
     CH  31-31       120-80    .7844   200-120   5.0698   500-200   8.8551 155M
     CH  32-32       120-80    .8063   200-120   5.2385   500-200   9.1382 160M
     CH  33-33       120-80    .8299   200-120   5.4115   500-200   9.4248 165M
     CH  34-34       120-80    .8520   200-120   5.5846   500-200   9.7122 170M
     CH  35-35       120-80    .8651   200-120   5.7560   500-200   9.9998 175M
     CH  36-36       120-80    .8763   200-120   5.9319   500-200  10.2857 180M
     CH  37-37       120-80    .8982   200-120   6.1072   500-200  10.5708 185M
     CH  38-38       120-80    .9116   200-120   6.2780   500-200  10.8588 190M
     CH  39-39       120-80    .9206   200-120   6.4600   500-200  11.1417 195M
     CH  40-40       120-80    .9389   200-120   6.6305   500-200  11.4292 200M
     CH  41-41       120-80    .9539   200-120   6.8050   500-200  11.7191 205M
     CH  42-42       120-80    .9731   200-120   6.9786   500-200  12.0062 210M
     CH  43-43       120-80    .9958   200-120   7.1543   500-200  12.2892 215M
     CH  44-44       120-80   1.0096   200-120   7.3286   500-200  12.5709 220M
     CH  45-45       120-80   1.0192   200-120   7.5041   500-200  12.8613 225M
     CH  46-46       120-80   1.0329   200-120   7.6793   500-200  13.1468 230M
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1972 NOV STATION 77 PA 10**4 AVG 5 DEPTH 144 M SWEEP 170 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 3     120-80  1.6363   200-120  -.3044   500-200  -.5985   5M
     CH   4- 6     120-80  2.4774   200-120 -1.1408   500-200  -.5941  10M
     CH   7- 9     120-80  3.7617   200-120 -2.2903   500-200  -.5928  15M
     CH  10-12     120-80  4.6335   200-120 -3.1335   500-200  -.5951  20M
     CH  13-15     120-80  4.6852   200-120 -3.0758   500-200  -.6146  25M
     CH  16-18     120-80  4.6648   200-120 -2.8941   500-200  -.6408  30M
     CH  19-21     120-80  4.6694   200-120 -2.7154   500-200  -.6708  35M
     CH  22-24     120-80  4.7071   200-120 -2.5410   500-200  -.7009  40M
     CH  25-27     120-80  4.7449   200-120 -2.3718   500-200  -.7334  45M
     CH  28-30     120-80  4.7712   200-120 -2.1947   500-200  -.7624  50M
     CH  31-33     120-80  4.7998   200-120 -2.0112   500-200  -.7913  55M
     CH  34-36     120-80  4.8228   200-120 -1.8190   500-200  -.8196  60M
     CH  37-39     120-80  4.8450   200-120 -1.6170   500-200  -.8485  65M
     CH  40-42     120-80  4.8669   200-120 -1.4157   500-200  -.8761  70M
     CH  43-45     120-80  4.8906   200-120 -1.2106   500-200  -.9042  75M
     CH  46-48     120-80  4.9164   200-120 -1.0047   500-200  -.9301  80M
     CH  49-51     120-80  4.9376   200-120   -.7923  500-200  -.9600  85M
     CH  52-54     120-80  4.9524   200-120   -.5841  500-200  -.9911  90M
     CH  55-57     120-80  4.9704   200-120   -.3762  500-200 -1.0221  95M
     CH  58-60     120-80  4.9813   200-120   -.1615  500-200 -1.0534 100M
     CH  61-63     120-80  5.0046   200-120    .0434  500-200 -1.0830 105M
     CH  64-66     120-80  5.0348   200-120    .2435  500-200 -1.1128 110M
     CH  67-69     120-80  5.0588   200-120    .4488  500-200 -1.1441 115M
     CH  70-72     120-80  5.0774   200-120    .6614  500-200 -1.1741 120M
     CH  73-75     120-80  5.0905   200-120    .8712  500-200 -1.2054 125M
     CH  76-78     120-80  5.1154   200-120   1.0795  500-200 -1.2382 130M
     CH  79-81     120-80  5.1384   200-120   1.2857  500-200 -1.2710 135M
     CH  82-84     120-80  5.1550   200-120   1.4931  500-200 -1.3018 140M

1972 NOV STATION 78 PA 10**4 AVG 5 DEPTH 53 M SWEEP 67 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 7     120-80   .3595   200-120  -.5584   500-200  -.1004   5M
     CH   8-14     120-80   .8311   200-120 -1.3389   500-200  -.0491  10M
     CH  15-21     120-80  1.5551   200-120 -2.0402   500-200   .0139  15M
     CH  22-28     120-80  3.3663   200-120 -3.4425   500-200   .0755  20M
     CH  29-35     120-80  4.0532   200-120 -3.7056   500-200   .1226  25M
     CH  36-42     120-80  4.2313   200-120 -3.9088   500-200   .1665  30M
     CH  43-49     120-80  4.5809   200-120 -4.1312   500-200   .2100  35M
     CH  50-56     120-80  5.0347   200-120 -4.4249   500-200   .2499  40M
     CH  57-63     120-80  5.3143   200-120 -4.6619   500-200   .2925  45M
     CH  64-70     120-80  5.4653   200-120 -4.5997   500-200   .3358  50M


1972=NOV STATION 79 PA 10**4 AVG 5 DEPTH 25 M SWEEP 30 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-16     120-80   .0966   200-120  -.5368   500-200   .0716   5M
     CH  17-32     120-80   .1930   200-120   .7284   500-200   .1062  10M
     CH  33-48     120-80  -.0654   200-120   .0359   500-200   .1374  15M
     CH  49-64     120-80   .0956   200-120  -.0663   500-200   .1790  20M
     CH  65-80     120-80  1.1285   200-120  -.9235   500-200   .2068  25M
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1972 NOV STATION 83 PA 10**4 AVG 5 DEPTH 120 M SWEEP 140 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 3      120-80    .2449   200-120  -.1820    500-200    .0856    5M
     CH    4- 6      120-80    .4570   200-120  -.3430    500-200    .1894   10M
     CH    7- 9      120-80    .3711   200-120  -.5156    500-200    .3110   15M
     CH   10-12      120-80    .4727   200-120  -.7128    500-200    .4425   20M
     CH   13-15      120-80    .6786   200-120  -.9139    500-200    .5760   25M
     CH   16-18      120-80    .8766   200-120 -1.1070    500-200    .6975   30M
     CH   19-21      120-80   1.1005   200-120 -1.3182    500-200    .8103   35M
     CH   22-24      120-80   1.3287   200-120 -1.5398    500-200    .9201   40M
     CH   25-27      120-80   1.5700   200-120 -1.7721    500-200   1.0273   45M
     CH   28-30      120-80   1.7407   200-120 -1.9694    500-200   1.1357   50M
     CH   31-33      120-80   1.9560   200-120 -2.2051    500-200   1.2413   55M
     CH   34-36      120-80   2.1657   200-120 -2.4303    500-200   1.3476   60M
     CH   37-39      120-80   2.3931   200-120 -2.6693    500-200   1.4543   65M
     CH   40-42      120-80   2.6025   200-120 -2.8940    500-200   1.5604   70M
     CH   43-45      120-80   2.8166   200-120 -3.1264    500-200   1.6628   75M
     CH   46-48      120-80   3.0210   200-120 -3.3424    500-200   1.7657   80M
     CH   49-51      120-80   3.2294   200-120 -3.5532    500-200   1.8682   85M
     CH   52-54      120-80   3.4532   200-120 -3.7709    500-200   1.9730   90M
     CH   55-57      120-80   3.6557   200-120 -3.9775    500-200   2.0777   95M
     CH   58-60      120-80   3.8686   200-120 -4.1828    500-200   2.1850  100M
     CH   61-63      120-80   4.1133   200-120 -4.4133    500-200   2.2906  105M
     CH   64-66      120-80   4.3425   200-120 -4.6260    500-200   2.3965  110M
     CH   67-69      120-80   4.5583   200-120 -4.8244    500-200   2.5023  115M
     CH   70-72      120-80   4.7723   200-120 -5.0272    500-200   2.6084  120M
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1972 NOV STATION 85 PA 10**4 AVE 5 DEPTH 188 M SWEEP 192 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2      120-80  -.2492    200-120   .2692    500-200    .3568    5M
     CH    3- 4      120-80  -.2832    200-120   .5285    500-200    .7185   10M
     CH    5- 6      120-80  -.2449    200-120   .7787    500-200   1.0876   15M
     CH    7- 8      120-80  -.2458    200-120  1.0244    500-200   1.4682   20M
     CH    9-10      120-80  -.2052    200-120  1.2517    500-200   1.8410   25M
     CH   11-12      120-80  -.1684    200-120  1.4797    500-200   2.2000   30M
     CH   13-14      120-80  -.1265    200-120  1.6992    500-200   2.5550   35M
     CH   15-16      120-80  -.0904    200-120  1.9167    500-200   2.9084   40M
     CH   17-18      120-80  -.0538    200-120  2.1425    500-200   3.2620   45M
     CH   19-20      120-80  -.0169    200-120  2.3781    500-200   3.6129   50M
     CH   21-22      120-80   .0189    200-120  2.6178    500-200   3.9613   55M
     CH   23-24      120-80   .0540    200-120  2.8648    500-200   4.3125   60M
     CH   25-26      120-80   .0895    200-120  3.1119    500-200   4.6633   65M
     CH   27-28      120-80   .1209    200-120  3.3666    500-200   5.0140   70M
     CH   29-30      120-80   .1567    200-120  3.6162    500-200   5.3672   75M
     CH   31-32      120-80   .1898    200-120  3.8694    500-200   5.7167   80M
     CH   33-34      120-80   .2211    200-120  4.1219    500-200   6.0708   85M
     CH   35-36      120-80   .2540    200-120  4.3723    500-200   6.4196   90M
     CH   37-38      120-80   .2834    200-120  4.6282    500-200   6.7735   95M
     CH   39-40      120-80   .3230    200-120  4.8788    500-200   7.1252  100M
     CH   41-42      120-80   .3643    200-120  5.1294    500-200   7.4799  105M
     CH   43-44      120-80   .3955    200-120  5.3832    500-200   7.8328  110M
     CH   45-46      120-80   .5119    200-120  5.5532    500-200   8.1877  115M
     CH   47-48      120-80   .5591    200-120  5.7960    500-200   8.5415  120M
     CH   49-50      120-80   .6009    200-120  6.0424    500-200   8.8977  125M
     CH   51-52      120-80   .6404    200-120  6.2894    500-200   9.2501  130M
     CH   53-54      120-80   .6770    200-120  6.5381    500-200   9.6032  135M
     CH   55-56      120-80   .7165    200-120  6.7851    500-200   9.9554  140M
     CH   57-58      120-80   .7464    200-120  7.0340    500-200  10.3047  145M
     CH   59-60      120-80   .7886    200-120  7.2833    500-200  10.6576  150M
     CH   61-62      120-80   .8270    200-120  7.5314    500-200  11.0097  155M
     CH   63-64      120-80   .8731    200-120  7.7775    500-200  11.3628  160M
     CH   65-66      120-80   .9095    200-120  8.0223    500-200  11.7186  165M
     CH   67-68      120-80   .9319    200-120  8.2853    500-200  12.0734  170M
     CH   69-70      120-80   .9705    200-120  8.5401    500-200  12.4307  175M
     CH   71-72      120-80  1.0020    200-120  8.7988    500-200  12.7896  180M
     CH   73-74      120-80  1.0402    200-120  9.0468    500-200  13.1472  185M

1972 NOV STATION 89 PA 10**4 AVE 5 DEPTH 68 M SWEEP 80 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 6      120-80   .0946    200-120  -.7421    500-200    .0068    5M
     CH    7-12      120-80   .8720    200-120 -2.1821    500-200    .0404   10M
     CH   13-18      120-80  1.5918    200-120 -3.5882    500-200    .0859   15M
     CH   19-24      120-80  1.7826    200-120 -4.4446    500-200    .1292   20M
     CH   25-30      120-80  1.8959    200-120 -5.2017    500-200    .1599   25M
     CH   31-36      120-80  1.2547    200-120 -5.2321    500-200    .1858   30M
     CH   37-42      120-80   .3843    200-120 -5.0345    500-200    .2123   35M
     CH   43-48      120-80  -.4963    200-120 -4.8367    500-200    .2353   40M
     CH   49-54      120-80 -1.3239    200-120 -4.6906    500-200    .2728   45M
     CH   55-60      120-80 -2.1477    200-120 -4.5621    500-200    .2948   50M
     CH   61-66      120-80 -3.0031    200-120 -4.4009    500-200    .3186   55M
     CH   67-72      120-80 -3.8611    200-120 -4.2409    500-200    .3420   60M
     CH   73-78      120-80 -4.1122    200-120 -4.0845    500-200    .3638   65M
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1972 NOV STATION 90 PA 10**4 AVG 5 DEPTH 24 M SWEEP 30 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-20     120-80   .0978   200-120  -.7552   500-200   .4106   5M
     CH  21-40     120-80  -.5087   200-120  -.8043   500-200   .7112  10M
     CH  41-60     120-80  -.4720   200-120 -1.6714   500-200  1.0245  15M
     CH  61-80     120-80 -1.0150   200-120 -1.9675   500-200  1.3324  20M

1972 NOV STATION 92 PA 10**4 AVG 5 DEPTH 67 M SWEEP 100 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 5     120-80  1.3079   200-120 -1.5868   500-200   .0397   5M
     CH   6-10     120-80  2.8920   200-120 -3.0342   500-200   .1028  10M
     CH  11-15     120-80  2.9327   200-120 -2.8930   500-200   .1829  15M
     CH  16-20     120-80  1.9396   200-120 -2.8501   500-200   .2687  20M
     CH  21-25     120-80   .9189   200-120 -2.8353   500-200   .3375  25M
     CH  26-30     120-80  2.7873   200-120 -4.5669   500-200   .4005  30M
     CH  31-35     120-80  3.7091   200-120 -5.4865   500-200   .4574  35M
     CH  36-40     120-80  4.1464   200-120 -5.8055   500-200   .5121  40M
     CH  41-45     120-80  4.2989   200-120 -5.8203   500-200   .5693  45M
     CH  46-50     120-80  4.4190   200-120 -5.8360   500-200   .6231  50M
     CH  51-55     120-80  4.6177   200-120 -5.9308   500-200   .6802  55M
     CH  56-60     120-80  4.7017   200-120 -5.9048   500-200   .7492  60M
     CH  61-65     120-80  4.6262   200-120 -5.7151   500-200   .8056  65M

1972 NOV STATION 94 PA 10**4 AVE 5 DEPTH 39 M SWEEP 45 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-12     120-80  -.2660   200-120  -.3432   500-200   .0636   5M
     CH  13-24     120-80  -.8184   200-120  -.5138   500-200   .1547  10M
     CH  25-36     120-80 -1.6567   200-120  -.4034   500-200   .2605  15M
     CH  37-48     120-80 -2.5243   200-120  -.2682   500-200   .3605  20M
     CH  49-60     120-80 -3.3878   200-120  -.1374   500-200   .4472  25M
     CH  61-72     120-80 -4.2615   200-120  -.0016   500-200   .5308  30M
     CH  73-84     120-80 -5.1381   200-120   .1407   500-200   .6128  35M

1972 NOV STATION 95 PA 10**4 AVE 5 DEPTH 33 M SWEEP 40 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-13     120-80   .0970   200-120   .4064   500-200  -.1459   5M
     CH  14-26     120-80   .8793   200-120  -.9041   500-200  -.1585  10M
     CH  27-39     120-80   .3669   200-120 -1.1571   500-200  -.1568  15M
     CH  40-52     120-80  -.0180   200-120 -1.1612   500-200  -.1556  20M
     CH  53-65     120-80   .0306   200-120 -1.0858   500-200  -.1653  25M
     CH  66-78     120-80 -1.3912   200-120  -.9611   500-200  -.1780  30M
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1972 NOV STATION 96 PA 10**4 AVE 5 DEPTH 35 M SWEEP 42 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-11      120-80   .1287   200-120  -.9014   500-200   .1135   5M
     CH  12-22      120-80   .2557   200-120 -1.6050   500-200   .2039  10M
     CH  23-33      120-80  -.2119   200-120 -1.7887   500-200   .2888  15M
     CH  34-44      120-80   .3618   200-120 -3.0630   500-200   .4095  20M
     CH  45-55      120-80   .2065   200-120 -3.6621   500-200   .5231  25M
     CH  56-66      120-80  -.3752   200-120 -3.8271   500-200   .6305  30M
     CH  67-77      120-80 -1.1883   200-120 -3.7676   500-200   .7357  35M


1972 NOV STATION 97 PA 10**4 AVG 5 DEPTH 29 M SWEEP 38 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-15      120-80  -.8487   200-120  -.3898   500-200   .1324   5M
     CH  16-30      120-80  -.4276   200-120  -.8441   500-200   .2686  10M
     CH  31-45      120-80  -.1704   200-120 -1.1566   500-200   .4173  15M
     CH  46-60      120-80   .0706   200-120 -1.2718   500-200   .5616  20M
     CH  61-75      120-80   .1947   200-120 -1.2711   500-200   .7025  25M

1972 NOV STATION 98 PA 10**4 AVE 5 DEPTH 30 M SWEEP 36 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-13      120-80  -.1633   200-120  -.8041   500-200   .0478   5M
     CH  14-26      120-80  -.7325   200-120  -.9913   500-200   .0932  10M
     CH  27-39      120-80 -1.4240   200-120  -.9897   500-200   .1520  15M
     CH  40-52      120-80 -2.2039   200-120  -.9156   500-200   .2171  20M
     CH  53-65      120-80 -3.0533   200-120  -.7745   500-200   .2718  25M
     CH  66-78      120-80 -3.9241   200-120  -.6180   500-200   .3236  30M

1972 NOV STATION 99 PA 10**4 AVE 5 DEPTH 40 M  SWEEP 54 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 9      120-80   .0963   200-120   .5061   500-200   .3354   5M
     CH  10-18      120-80   .1926   200-120  -.2969   500-200   .5441  10M
     CH  19-27      120-80   .2885   200-120 -1.0945   500-200   .7675  15M
     CH  28-36      120-80   .3842   200-120 -1.9135   500-200   .9904  20M
     CH  37-45      120-80   .4798   200-120 -2.7257   500-200  1.1989  25M
     CH  46-54      120-80   .1847   200-120 -3.1333   500-200  1.4036  30M
     CH  55-63      120-80  1.1136   200-120 -4.7828   500-200  1.6077  35M
     CH  64-72      120-80  1.5971   200-120 -5.9861   500-200  1.8032  40M
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1972 NOV STATION 103 PA 10**4 AVE 5 DEPTH 27 M SWEEP 29 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-18     120-80   .0972   200-120   .4629   500-200   .1129   5M
     CH  19-36     120-80   .1941   200-120   .9023   500-200   .3166  10M
     CH  37-54     120-80   .2909   200-120   .5214   500-200   .5488  15M
     CH  55-72     120-80   .3876   200-120  -.1561   500-200   .7782  20M
     CH  73-90     120-80   .2619   200-120  -.7775   500-200   .9796  25M
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1972 NOV STATION 105 PA 10**4 AVE 5 DEPTH 26 M SWEEP 31 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-16     120-80   .0977   200-120  -.8351   500-200   .1192   5M
     CH  17-32     120-80  -.8395   200-120  -.0104   500-200   .2514  10M
     CH  33-48     120-80  -.6596   200-120  -.5077   500-200   .3970  15M
     CH  49-64     120-80  -.7898   200-120  -.8787   500-200   .5480  20M
     CH  65-80     120-80 -1.3465   200-120  -.9469   500-200   .6914  25M
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1973 FEB STA 1 PA 10**4 AVG 5 DEPTH 33M DEPTH 35M SCAN 50 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-10     120-80   .1125   200-120   .2220   500-200  -.3060   5M
     CH  11-20     120-80   .2678   200-120   .5775   500-200  -.0952  10M
     CH  21-30     120-80  1.1600   200-120   .7082   500-200   .1095  15M
     CH  31-40     120-80   .1962   200-120  1.0101   500-200   .3151  20M
     CH  41-50     120-80   .6561   200-120  -.0086   500-200   .5217  25M
     CH  51-60     120-80   .9536   200-120  -.8594   500-200   .7301  30M
     CH  61-70     120-80  1.1588   200-120 -1.5034   500-200   .9390  35M

1973 STATION 3 FEB PA 10**4 AVE 5 DEPTH 15 M DEPTH  18 M SCAN 25 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-24     120-80 -1.3841   200-120   .5780   500-200  -.5970   5M
     CH  25-48     120-80 -3.0360   200-120  -.0353   500-200  -.5342  10M
     CH  49-72     120-80 -4.6428   200-120  -.7348   500-200  -.4740  15M

1973 FEB STA 7 PA 10**4 AVG 5 DEPPTH 16 DEPTH 24 M SCAN 35 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-17     120-80   .7373   200-120 -1.2644   500-200  -.0314   5M
     CH  18-34     120-80  -.1422   200-120 -1.1144   500-200   .0248  10M
     CH  35-51     120-80   .5749   200-120 -2.4339   500-200   .0682  15M
     CH  52-68     120-80   .8997   200-120 -3.5311   500-200   .1100  20M

1973 FEB STATION 8 PA **4 AVE 5  DEPTH 15 M DEPTH 65 M SWEEP 72 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 6     120-80   .0982   200-120  -.0886   500-200  -.3443   5M
     CH   7-12     120-80   .7623   200-120  -.7466   500-200  -.3762  10M
     CH  13-18     120-80  1.1129   200-120 -2.2914   500-200  -.4043  15M
     CH  19-24     120-80   .5492   200-120 -2.5793   500-200  -.4338  20M
     CH  25-30     120-80   .0418   200-120 -2.6226   500-200  -.4863  25M
     CH  31-36     120-80  -.3578   200-120 -2.5898   500-200  -.5141  30M
     CH  37-42     120-80  -.5799   200-120 -2.5678   500-200  -.5455  35M
     CH  43-48     120-80  -.7505   200-120 -2.5267   500-200  -.5667  40M
     CH  49-54     120-80  -.8398   200-120 -2.5099   500-200  -.6011  45M
     CH  55-60     120-80  -.8722   200-120 -2.4949   500-200  -.6337  50M
     CH  61-66     120-80  -.9014   200-120 -2.4705   500-200  -.6648  55M
     CH  67-72     120-80  -.9282   200-120 -2.4559   500-200  -.6955  60M
     CH  73-78     120-80  -.9562   200-120 -2.4405   500-200  -.7239  65M
1973 STATION 14 FEB PA 10**4 AVE 5 DEPTH 10 M DEPTH 14 M SWEEP 14 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-50     120-80   .1038   200-120   .5431   500-200  -.4788   5M
     CH  51-**     120-80   .8514   200-120  1.0852   500-200  -.6596  10M
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1973 STATION 19 FEB PA 10**4 AVE 5 DEPTH 14 M DEPTH 21.M SWEEP 24 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-21     120-80  -.5907   200-120   .5455   500-200 -1.2900   5M
     CH  22-42     120-80   .0475   200-120  1.0907   500-200 -2.0821  10M
     CH  43-63     120-80   .5645   200-120  1.6347   500-200 -2.0663  15M
     CH  64-84     120-80  1.2147   200-120  2.1780   500-200 -2.0553  20M
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1973 FEB STATION 20 PA 10**4 AVE 5 DEPTH 18 DEPTH 23 SWEEP 27
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-21     120-80  -.7741   200-120  1.5747   500-200   -.2452   5M
     CH  22-42     120-80 -1.1313   200-120  2.1972   500-200   -.2476  10M
     CH  43-63     120-80 -1.2090   200-120  2.5493   500-200   -.2478  15M
     CH  64-84     120-80 -1.2169   200-120  3.0525   500-200   -.2448  20M
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1973 STATION 24 PA 10**4 AVE 5 DEPTH 114 M DEPTH 123 M SWEEP 150 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 3     120-80   .1785   200-120  -.2741    500-200  -.2559    5M
     CH   4- 6     120-80   .3038   200-120  -.3126    500-200  -.2606   10M
     CH   7- 9     120-80  -.6011   200-120  -.3417    500-200  -.2599   15M
     CH  10-12     120-80  -.7063   200-120  -.3112    500-200  -.2606   20M
     CH  13-15     120-80  -.7110   200-120  -.3071    500-200  -.2600   25M
     CH  16-18     120-80  -.7014   200-120  -.3031    500-200  -.2619   30M
     CH  19-21     120-80  -.7001   200-120  -.3002    500-200  -.2633   35M
     CH  22-24     120-80  -.6921   200-120  -.2971    500-200  -.2635   40M
     CH  25-27     120-80  -.6851   200-120  -.2971    500-200  -.2652   45M
     CH  28-30     120-80  -.6906   200-120  -.2969    500-200  -.2682   50M
     CH  31-33     120-80  -.6894   200-120  -.2956    500-200  -.2702   55M
     CH  34-36     120-80  -.6964   200-120  -.2916    500-200  -.2717   60M
     CH  37-39     120-80  -.7053   200-120  -.2886    500-200  -.2727   65M
     CH  40-42     120-80  -.7078   200-120  -.2899    500-200  -.2752   70M
     CH  43-45     120-80  -.7116   200-120  -.2902    500-200  -.2756   75M
     CH  46-48     120-80  -.7102   200-120  -.2866    500-200  -.2747   80M
     CH  49-51     120-80  -.7211   200-120  -.2836    500-200  -.2744   85M
     CH  52-54     120-80  -.7234   200-120  -.2817    500-200  -.2725   90M
     CH  55-57     120-80  -.7284   200-120  -.2787    500-200  -.2734   95M
     CH  58-60     120-80  -.7387   200-120  -.2745    500-200  -.2722  100M
     CH  61-63     120-80  -.7429   200-120  -.2738    500-200  -.2702  105M
     CH  64-66     120-80  -.7505   200-120  -.2734    500-200  -.2668  110M
     CH  67-69     120-80  -.7536   200-120  -.2739    500-200  -.2644  115M
     CH  70-72     120-80  -.7559   200-120  -.2726    500-200  -.2639  120M
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1973 FEB STATION 26 PA 10**4 AVE 5 DEPTH 146 M SCAN 175 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 2     120-80  -.2514   200-120 -1.1803   500-200   .0054    5M
     CH   3- 4     120-80   .5200   200-120 -2.4454   500-200  -.0012   10M
     CH   5- 6     120-80   .6059   200-120 -2.6405   500-200  -.0030   15M
     CH   7- 8     120-80   .6002   200-120 -2.6300   500-200  -.0067   20M
     CH   9-10     120-80   .6071   200-120 -2.6253   500-200  -.0086   25M
     CH  11-12     120-80   .6022   200-120 -2.6137   500-200  -.0160   30M
     CH  13-14     120-80   .6018   200-120 -2.6056   500-200  -.0181   35M
     CH  15-16     120-80   .6029   200-120 -2.5969   500-200  -.0251   40M
     CH  17-18     120-80   .5967   200-120 -2.5847   500-200  -.0282   45M
     CH  19-20     120-80   .5936   200-120 -2.5761   500-200  -.0373   50M
     CH  21-22     120-80   .5900   200-120 -2.5638   500-200  -.0426   55M
     CH  23-24     120-80   .5931   200-120 -2.5530   500-200  -.0543   60M
     CH  25-26     120-80   .5951   200-120 -2.5461   500-200  -.0617   65M
     CH  27-28     120-80   .6008   200-120 -2.5443   500-200  -.0700   70M
     CH  29-30     120-80   .5937   200-120 -2.5334   500-200  -.0776   75M
     CH  31-32     120-80   .5962   200-120 -2.5229   500-200  -.0872   80M
     CH  33-34     120-80   .5933   200-120 -2.5116   500-200  -.0981   85M
     CH  35-36     120-80   .5934   200-120 -2.5041   500-200  -.1062   90M
     CH  37-38     120-80   .5909   200-120 -2.4905   500-200  -.1176   95M
     CH  39-40     120-80   .5907   200-120 -2.4796   500-200  -.1270  100M
     CH  41-42     120-80   .5904   200-120 -2.4686   500-200  -.1415  105M
     CH  43-44     120-80   .5979   200-120 -2.4657   500-200  -.1534  110M
     CH  45-46     120-80   .6000   200-120 -2.4559   500-200  -.1676  115M
     CH  47-48     120-80   .5990   200-120 -2.4410   500-200  -.1799  120M
     CH  49-50     120-80   .5973   200-120 -2.4276   500-200  -.1953  125M
     CH  51-52     120-80   .5975   200-120 -2.4173   500-200  -.2096  130M
     CH  53-54     120-80   .5978   200-120 -2.4105   500-200  -.2231  135M
     CH  55-56     120-80   .5946   200-120 -2.3968   500-200  -.2370  140M
     CH  57-58     120-80   .5967   200-120 -2.3840   500-200  -.2488  145M
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1973 FEB STA 30 PA 10** 4 AVG 5 DEPTH 20 M DEPTH 24 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-20     120-80   .6594   200-120  1.4782   500-200  -.6290    5M
     CH  21-40     120-80   .9171   200-120  2.5723   500-200  -.5389   10M
     CH  41-60     120-80  1.1878   200-120  3.4764   500-200  -.4517   15M
     CH  61-80     120-80  1.4397   200-120  4.3405   500-200  -.3527   20M
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1973 FEB STA 31 PA 10**4 AVG 5 DEPTH 28 M DEPTH 29 M  SCAN 35 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-14     120-80   .0985   200-120   .5618   500-200  -.6616    5M
     CH  15-28     120-80   .1969   200-120  1.0879   500-200  -.6274   10M
     CH  29-42     120-80   .2951   200-120  1.0697   500-200  -.5889   15M
     CH  43-56     120-80   .3930   200-120   .2656   500-200  -.5045   20M
     CH  57-70     120-80   .4907   200-120  1.8102   500-200  -.4070   25M
     CH  71-84     120-80   .5883   200-120  3.0687   500-200  -.2403   30M
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1973 FEB STA 32 PA 10**4 AVG 5 DEPTH 171 M DEPTH 180 M SCAN 200 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2     120-80  -.1686   200-120   .5542   500-200  -.1864    5M
     CH    3- 4     120-80  -.1786   200-120   .5742   500-200  -.0797   10M
     CH    5- 6     120-80  -.1938   200-120   .5824   500-200   .0258   15M
     CH    7- 8     120-80  -.1962   200-120   .5808   500-200   .1310   20M
     CH    9-10     120-80  -.1950   200-120   .5787   500-200   .2379   25M
     CH   11-12     120-80  -.2001   200-120   .5785   500-200   .3437   30M
     CH   13-14     120-80  -.2041   200-120   .5815   500-200   .4486   35M
     CH   15-16     120-80  -.2044   200-120   .5736   500-200   .5563   40M
     CH   17-18     120-80  -.2011   200-120   .5622   500-200   .6635   45M
     CH   19-20     120-80  -.2032   200-120   .5567   500-200   .7686   50M
     CH   21-22     120-80  -.1997   200-120   .5475   500-200   .8740   55M
     CH   23-24     120-80  -.1937   200-120   .5350   500-200   .9786   60M
     CH   25-26     120-80  -.1998   200-120   .5295   500-200  1.0819   65M
     CH   27-28     120-80  -.2013   200-120   .5248   500-200  1.1843   70M
     CH   29-30     120-80  -.1955   200-120   .5118   500-200  1.2884   75M
     CH   31-32     120-80  -.1944   200-120   .5004   500-200  1.3925   80M
     CH   33-34     120-80  -.1994   200-120   .4957   500-200  1.4957   85M
     CH   35-36     120-80  -.2007   200-120   .4864   500-200  1.5988   90M
     CH   37-38     120-80  -.2047   200-120   .4792   500-200  1.7026   95M
     CH   39-40     120-80  -.2169   200-120   .4796   500-200  1.8055  100M
     CH   41-42     120-80  -.2181   200-120   .4755   500-200  1.9099  105M
     CH   43-44     120-80  -.2168   200-120   .4625   500-200  2.0149  110M
     CH   45-46     120-80  -.2230   200-120   .4600   500-200  2.1182  115M
     CH   47-48     120-80  -.2239   200-120   .4528   500-200  2.2204  120M
     CH   49-50     120-80  -.2160   200-120   .4367   500-200  2.3244  125M
     CH   51-52     120-80  -.2129   200-120   .4264   500-200  2.4265  130M
     CH   53-54     120-80  -.2176   200-120   .4219   500-200  2.5300  135M
     CH   55-56     120-80  -.2114   200-120   .4079   500-200  2.6312  140M
     CH   57-58     120-80  -.2088   200-120   .3945   500-200  2.7331  145M
     CH   59-60     120-80  -.2131   200-120   .3901   500-200  2.8333  150M
     CH   61-62     120-80  -.2081   200-120   .3774   500-200  2.9337  155M
     CH   63-64     120-80  -.2000   200-120   .3563   500-200  3.0343  160M
     CH   65-66     120-80  -.2017   200-120   .3505   500-200  3.1348  165M
     CH   67-68     120-80  -.2065   200-120   .3465   500-200  3.2342  170M
     CH   69-70     120-80  -.1976   200-120   .3305   500-200  3.3311  175M
     CH   71-72     120-80  -.2007   200-120   .3246   500-200  3.4294  180M
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1973 FEB STA 34 PA 10**4 AVG 5 DEPTH 85  DEPTH 88 M  SCAN 125 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 4     120-80   .0954   200-120  -.1242   500-200  -.1152    5M
     CH    5- 8     120-80   .6751   200-120  -.9629   500-200  -.0080   10M
     CH    9-12     120-80   .1283   200-120 -1.0829   500-200   .0973   15M
     CH   13-16     120-80   .0605   200-120 -1.0558   500-200   .1927   20M
     CH   17-20     120-80  -.0412   200-120 -1.0649   500-200   .2960   25M
     CH   21-24     120-80  -.1193   200-120 -1.0766   500-200   .4027   30M
     CH   25-28     120-80  -.0950   200-120 -1.0952   500-200   .5094   35M
     CH   29-32     120-80  -.0892   200-120 -1.1012   500-200   .6141   40M
     CH   33-36     120-80  -.1011   200-120 -1.0904   500-200   .7162   45M
     CH   37-40     120-80  -.1032   200-120 -1.0875   500-200   .8235   50M
     CH   41-44     120-80  -.1084   200-120 -1.0871   500-200   .9291   55M
     CH   45-48     120-80  -.1049   200-120 -1.0964   500-200  1.0270   60M
     CH   49-52     120-80  -.1006   200-120 -1.0954   500-200  1.1293   65M
     CH   53-56     120-80  -.1135   200-120 -1.0744   500-200  1.2361   70M
     CH   57-60     120-80  -.1157   200-120 -1.0744   500-200  1.3389   75M
     CH   61-64     120-80  -.1216   200-120 -1.0743   500-200  1.4440   80M
     CH   65-68     120-80  -.1272   200-120 -1.0844   500-200  1.5450   85M
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1973 FEB STA 35 PA 10**4 AVG 5 DEPTH 18 M DEPTH 16 M SCAN 25 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-21     120-80   .1115   200-120   .5798    500-200  -.8430    5M
     CH   22-42     120-80   .2223   200-120  -.0810    500-200 -1.0417   10M
     CH   43-63     120-80   .3329   200-120  -.9458    500-200  -.9306   15M
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1973 FEB STA 42 PA 10**4 AVG 5 DEPTH 15 M DEPTH 29 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-16     120-80   .1021   200-120   .6362    500-200 -1.1758    5M
     CH   17-32     120-80   .2041   200-120  1.2714    500-200 -1.1877   10M
     CH   33-48     120-80   .3060   200-120  1.9058    500-200 -1.1843   15M
     CH   49-64     120-80   .4080   200-120  2.5392    500-200 -1.1861   20M
     CH   65-80     120-80   .3497   200-120  3.6953    500-200 -1.1883   25M
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1973 FEB STATION 44 PA 10**4 AVG 5 DEPTH L74 M DEPTH 189 M SCAN 200 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2     120-80   .8657   200-120  -.8411    500-200  -.1005    5M
     CH    3- 4     120-80  1.4492   200-120 -1.9877    500-200  -.1018   10M
     CH    5- 6     120-80  1.7975   200-120 -2.3305    500-200  -.1051   15M
     CH    7- 8     120-80  1.8102   200-120 -2.3275    500-200  -.1088   20M
     CH    9-10     120-80  1.7981   200-120 -2.3139    500-200  -.1113   25M
     CH   11-12     120-80  1.7988   200-120 -2.3061    500-200  -.1150   30M
     CH   13-14     120-80  1.7953   200-120 -2.2983    500-200  -.1203   35M
     CH   15-16     120-80  1.7828   200-120 -2.2865    500-200  -.1266   40M
     CH   17-18     120-80  1.7760   200-120 -2.2788    500-200  -.1331   45M
     CH   19-20     120-80  1.7662   200-120 -2.2673    500-200  -.1401   50M
     CH   21-22     120-80  1.7562   200-120 -2.2594    500-200  -.1456   55M
     CH   23-24     120-80  1.7448   200-120 -2.2491    500-200  -.1511   60M
     CH   25-26     120-80  1.7361   200-120 -2.2386    500-200  -.1572   65M
     CH   27-28     120-80  1.7312   200-120 -2.2305    500-200  -.1645   70M
     CH   29-30     120-80  1.7251   200-120 -2.2199    500-200  -.1727   75M
     CH   31-32     120-80  1.7158   200-120 -2.2110    500-200  -.1814   80M
     CH   33-34     120-80  1.6997   200-120 -2.1991    500-200  -.1895   85M
     CH   35-36     120-80  1.6901   200-120 -2.1876    500-200  -.1993   90M
     CH   37-38     120-80  1.6805   200-120 -2.1756    500-200  -.2083   95M
     CH   39-40     120-80  1.6736   200-120 -2.1658    500-200  -.2187  100M
     CH   41-42     120-80  1.6666   200-120 -2.1564    500-200  -.2282  105M
     CH   43-44     120-80  1.6563   200-120 -2.1466    500-200  -.2388  110M
     CH   45-46     120-80  1.6480   200-120 -2.1333    500-200  -.2479  115M
     CH   47-48     120-80  1.6389   200-120 -2.1216    500-200  -.2595  120M
     CH   49-50     120-80  1.6288   200-120 -2.1124    500-200  -.2707  125M
     CH   51-52     120-80  1.6185   200-120 -2.1018    500-200  -.2795  130M
     CH   53-54     120-80  1.6106   200-120 -2.0914    500-200  -.2912  135M
     CH   55-56     120-80  1.6011   200-120 -2.0804    500-200  -.3017  140M
     CH   57-58     120-80  1.5978   200-120 -2.0738    500-200  -.3127  145M
     CH   59-60     120-80  1.5903   200-120 -2.0678    500-200  -.3220  150M
     CH   61-62     120-80  1.5827   200-120 -2.0569    500-200  -.3293  155M
     CH   63-64     120-80  1.5721   200-120 -2.0439    500-200  -.3373  160M
     CH   65-66     120-80  1.5602   200-120 -2.0314    500-200  -.3440  165M
     CH   67-68     120-80  1.5517   200-120 -2.0206    500-200  -.3507  170M
     CH   69-70     120-80  1.5432   200-120 -2.0098    500-200  -.3576  175M
     CH   71-72     120-80  1.5386   200-120 -2.0028    500-200  -.3625  180M
     CH   73-74     120-80  1.5293   200-120 -1.9931    500-200  -.3684  185M
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1973 STATION 46 FEB PA 10**4 AVE 5 DEPTH 120 DEPTH 130 SWEEP 180
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2     120-80    .0404   200-120   .2818   500-200   -.4419    5M
     CH    3- 4     120-80    .0345   200-120   .2164   500-200   -.4403   10M
     CH    5- 6     120-80    .0299   200-120   .2273   500-200   -.4465   15M
     CH    7- 8     120-80    .0305   200-120   .2364   500-200   -.4465   20M
     CH    9-10     120-80    .0246   200-120   .2502   500-200   -.4558   25M
     CH   11-12     120-80    .0183   200-120   .2642   500-200   -.4540   30M
     CH   13-14     120-80    .0106   200-120   .2783   500-200   -.4628   35M
     CH   15-16     120-80    .0081   200-120   .2934   500-200   -.4631   40M
     CH   17-18     120-80    .0013   200-120   .3143   500-200   -.4741   45M
     CH   19-20     120-80   -.0062   200-120   .3322   500-200   -.4770   50M
     CH   21-22     120-80   -.0113   200-120   .3455   500-200   -.4900   55M
     CH   23-24     120-80   -.0191   200-120   .3609   500-200   -.4948   60M
     CH   25-26     120-80   -.0257   200-120   .3801   500-200   -.5076   65M
     CH   27-28     120-80   -.0336   200-120   .3976   500-200   -.5126   70M
     CH   29-30     120-80   -.0379   200-120   .4105   500-200   -.5257   75M
     CH   31-32     120-80   -.0441   200-120   .4267   500-200   -.5314   80M
     CH   33-34     120-80   -.0516   200-120   .4422   500-200   -.5411   85M
     CH   35-36     120-80   -.0616   200-120   .4592   500-200   -.5494   90M
     CH   37-38     120-80   -.0657   200-120   .4730   500-200   -.5613   95M
     CH   39-40     120-80   -.0715   200-120   .4886   500-200   -.5699  100M
     CH   41-42     120-80   -.0763   200-120   .5036   500-200   -.5786  105M
     CH   43-44     120-80   -.0848   200-120   .5237   500-200   -.5871  110M
     CH   45-46     120-80   -.0949   200-120   .5424   500-200   -.5964  115M
     CH   47-48     120-80   -.0973   200-120   .5541   500-200   -.6088  120M
     CH   49-50     120-80   -.1027   200-120   .5710   500-200   -.6153  125M
     CH   51-52     120-80   -.1089   200-120   .5895   500-200   -.6260  130M


1973 FEB STA 48 PA 10**4 AVG 5 DEPTH 26 DEPTH 29 SWEEP 35
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-14     120-80   -.6173   200-120  1.2849   500-200   -.8625    5M
     CH   15-28     120-80    .3128   200-120   .9321   500-200   -.8409   10M
     CH   29-42     120-80    .9539   200-120  -.4614   500-200   -.8226   15M
     CH   43-56     120-80    .8715   200-120  1.0192   500-200   -.8059   20M
     CH   57-70     120-80    .4674   200-120  2.3054   500-200   -.7905   25M
     CH   71-84     120-80    .0103   200-120  3.6965   500-200   -.7752   30M


1973 FEB STA 60 PPAMP 10**4 AVG 5 DEPTH 12 DEPTH  12 M  SCAN 20 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-30     120-80    .1107   200-120   .5831   500-200    .1354    5M
     CH   31-60     120-80   -.8597   200-120   .9655   500-200    .1448   10M
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1973 FEP STA 62  PA 10**4 AVG 5 DEPTH 169 M DEPTH 185 M SCAN 250 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2     120-80  -.0170   200-120  -.0014    500-200    .0651    5M
     CH    3- 4     120-80  -.0442   200-120   .0058    500-200    .1282   10M
     CH    5- 6     120-80  -.0676   200-120   .0154    500-200    .1912   15M
     CH    7- 8     120-80  -.0932   200-120   .0283    500-200    .2552   20M
     CH    9-10     120-80  -.1224   200-120   .0387    500-200    .3213   25M
     CH   11-12     120-80  -.1575   200-120   .0534    500-200    .3894   30M
     CH   13-14     120-80  -.1806   200-120   .0623    500-200    .4549   35M
     CH   15-16     120-80  -.2061   200-120   .0688    500-200    .5201   40M
     CH   17-18     120-80  -.2383   200-120   .0776    500-200    .5864   45M
     CH   19-20     120-80  -.2649   200-120   .0833    500-200    .6522   50M
     CH   21-22     120-80  -.2911   200-120   .0887    500-200    .7201   55M
     CH   23-24     120-80  -.3193   200-120   .0956    500-200    .7839   60M
     CH   25-26     120-80  -.3432   200-120   .1034    500-200    .8491   65M
     CH   27-28     120-80  -.3725   200-120   .1127    500-200    .9164   70M
     CH   29-30     120-80  -.4000   200-120   .1184    500-200    .9828   75M
     CH   31-32     120-80  -.4269   200-120   .1251    500-200   1.0502   80M
     CH   33-34     120-80  -.4542   200-120   .1314    500-200   1.1149   85M
     CH   35-36     120-80  -.4774   200-120   .1377    500-200   1.1800   90M
     CH   37-38     120-80  -.5056   200-120   .1459    500-200   1.2454   95M
     CH   39-40     120-80  -.5320   200-120   .1511    500-200   1.3099  100M
     CH   41-42     120-80  -.5611   200-120   .1545    500-200   1.3740  105M
     CH   43-44     120-80  -.5923   200-120   .1626    500-200   1.4390  110M
     CH   45-46     120-80  -.6216   200-120   .1695    500-200   1.5036  115M
     CH   47-48     120-80  -.6446   200-120   .1783    500-200   1.5692  120M
     CH   49-50     120-80  -.6608   200-120   .1706    500-200   1.6336  125M
     CH   51-52     120-80  -.6825   200-120   .1740    500-200   1.6966  130M
     CH   53-54     120-80  -.7071   200-120   .1776    500-200   1.7606  135M
     CH   55-56     120-80  -.7387   200-120   .1794    500-200   1.8241  140M
     CH   57-58     120-80  -.7685   200-120   .1828    500-200   1.8876  145M
     CH   59-60     120-80  -.7977   200-120   .1896    500-200   1.9501  150M
     CH   61-62     120-80  -.8242   200-120   .1911    500-200   2.0131  155M
     CH   63-64     120-80  -.8494   200-120   .1963    500-200   2.0749  160M
     CH   65-66     120-80  -.8738   200-120   .2016    500-200   2.1378  165M
     CH   67-68     120-80  -.9006   200-120   .2052    500-200   2.2005  170M
     CH   69-70     120-80  -.9267   200-120   .2129    500-200   2.2634  175M
     CH   71-72     120-80  -.9520   200-120   .2158    500-200   2.3249  180M
     CH   73-74     120-80  -.9760   200-120   .2179    500-200   2.3877  185M
1973 STATION 64 FEP PA 10**4 AVE 5 DEPTH 85 M DEPTH 94 M SCAN 150 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 3     120-80   .8763   200-120  -.4489    500-200    .5206    5M
     CH    4- 6     120-80  1.6036   200-120  -.7837    500-200    .6192   10M
     CH    7- 9     120-80  1.3965   200-120  -.7949    500-200    .7113   15M
     CH   10-12     120-80  1.3559   200-120  -.7930    500-200    .8032   20M
     CH   13-15     120-80  1.3487   200-120  -.7886    500-200    .8968   25M
     CH   16-18     120-80  1.3515   200-120  -.7884    500-200    .9950   30M
     CH   19-21     120-80  1.3375   200-120  -.7783    500-200   1.0885   35M
     CH   22-24     120-80  1.3535   200-120  -.7911    500-200   1.1799   40M
     CH   25-27     120-80  1.3505   200-120  -.7831    500-200   1.2731   45M
     CH   28-30     120-80  1.3415   200-120  -.7697    500-200   1.3677   50M
     CH   31-33     120-80  1.3360   200-120  -.7642    500-200   1.4618   55M
     CH   34-36     120-80  1.3265   200-120  -.7532    500-200   1.5550   60M
     CH   37-39     120-80  1.3242   200-120  -.7497    500-200   1.6530   65M
     CH   40-42     120-80  1.3175   200-120  -.7435    500-200   1.7443   70M
     CH   43-45     120-80  1.3113   200-120  -.7355    500-200   1.8373   75M
     CH   46-48     120-80  1.3081   200-120  -.7286    500-200   1.9290   80M
     CH   49-51     120-80  1.3038   200-120  -.7381    500-200   2.0216   85M
     CH   52-54     120-80  1.3036   200-120  -.7349    500-200   2.1142   90M
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1973 STATION 66 FEB PA 10**4 AVE 5 DEPTH 12 M DEPTH 21 M SWEEP 27 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-19     120-80   .1250   200-120  1.0223   500-200   .0826   5M
     CH  20-38     120-80   .4456   200-120  1.2761   500-200   .0958  10M
     CH  39-57     120-80  1.2381   200-120  1.4655   500-200   .1031  15M
     CH  58-76     120-80  2.2753   200-120  2.0621   500-200   .1116  20M

1973 STATION 73 FEB PA 10**4 AVE 5 DEPTH 17 M DEPTH 18 M SWEEP 25 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-24     120-80  -.1606   200-120  2.2960   500-200  -.3296   5M
     CH  25-48     120-80  -.3956   200-120  1.8056   500-200  -.3192  10M
     CH  49-72     120-80  -.0980   200-120  3.2243   500-200  -.3111  15M

1973 STATION 75 FEB PA 10**4 AVE 5 DEPTH 233 M DEPTH 240 M SWEEP 260 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 1     120-80   .0112   200-120  -.1016   500-200  -.0133   5M
     CH   2- 2     120-80  -.1174   200-120  -.0952   500-200  -.0226  10M
     CH   3- 3     120-80  -.3888   200-120  -.0902   500-200  -.0339  15M
     CH   4- 4     120-80  -.5040   200-120  -.0885   500-200  -.0458  20M
     CH   5- 5     120-80  -.5427   200-120  -.0852   500-200  -.0524  25M
     CH   6- 6     120-80  -.5638   200-120  -.0875   500-200  -.0566  30M
     CH   7- 7     120-80  -.5906   200-120  -.0863   500-200  -.0623  35M
     CH   8- 8     120-80  -.6086   200-120  -.0849   500-200  -.0690  40M
     CH   9- 9     120-80  -.6304   200-120  -.0889   500-200  -.0749  45M
     CH  10-10     120-80  -.6496   200-120  -.0895   500-200  -.0797  50M
     CH  11-11     120-80  -.6653   200-120  -.0923   500-200  -.0864  55M
     CH  12-12     120-80  -.6874   200-120  -.0955   500-200  -.0910  60M
     CH  13-13     120-80  -.7086   200-120  -.0991   500-200  -.0940  65M
     CH  14-14     120-80  -.7298   200-120  -.1033   500-200  -.0997  70M
     CH  15-15     120-80  -.7513   200-120  -.1030   500-200  -.1057  75M
     CH  16-16     120-80  -.7710   200-120  -.1092   500-200  -.1111  80M
     CH  17-17     120-80  -.7986   200-120  -.1059   500-200  -.1155  85M
     CH  18-18     120-80  -.8195   200-120  -.1141   500-200  -.1135  90M
     CH  19-19     120-80  -.8351   200-120  -.1235   500-200  -.1128  95M
     CH  20-20     120-80  -.8564   200-120  -.1279   500-200  -.1135 100M
     CH  21-21     120-80  -.8657   200-120  -.1471   500-200  -.1166 105M
     CH  22-22     120-80  -.8848   200-120  -.1522   500-200  -.1198 110M
     CH  23-23     120-80  -.8941   200-120  -.1614   500-200  -.1212 115M
     CH  24-24     120-80  -.9023   200-120  -.1673   500-200  -.1251 120M
     CH  25-25     120-80  -.9162   200-120  -.1744   500-200  -.1278 125M
     CH  26-26     120-80  -.9328   200-120  -.1764   500-200  -.1332 130M
     CH  27-27     120-80  -.9573   200-120  -.1805   500-200  -.1360 135M
     CH  28-28     120-80  -.9783   200-120  -.1807   500-200  -.1395 140M
     CH  29-29     120-80  -.9944   200-120  -.1876   500-200  -.1411 145M
     CH  30-30     120-80 -1.0130   200-120  -.1935   500-200  -.1386 150M
     CH  31-31     120-80 -1.0360   200-120  -.2013   500-200  -.1384 155M
     CH  32-32     120-80 -1.0571   200-120  -.2058   500-200  -.1395 160M
     CH  33-33     120-80 -1.0762   200-120  -.2104   500-200  -.1409 165M
     CH  34-34     120-80 -1.0975   200-120  -.2146   500-200  -.1423 170M
     CH  35-35     120-80 -1.1197   200-120  -.2179   500-200  -.1443 175M
     CH  36-36     120-80 -1.1432   200-120  -.2227   500-200  -.1472 180M
     CH  37-37     120-80 -1.1675   200-120  -.2272   500-200  -.1494 185M
     CH  38-38     120-80 -1.1862   200-120  -.2332   500-200  -.1507 190M
     CH  39-39     120-80 -1.2089   200-120  -.2387   500-200  -.1528 195M
     CH  40-40     120-80 -1.2267   200-120  -.2431   500-200  -.1551 200M
     CH  41-41     120-80 -1.2451   200-120  -.2473   500-200  -.1565 205M
     CH  42-42     120-80 -1.2657   200-120  -.2515   500-200  -.1579 210M
     CH  43-43     120-80 -1.2860   200-120  -.2559   500-200  -.1563 215M
     CH  44-44     120-80 -1.3076   200-120  -.2608   500-200  -.1558 220M
     CH  45-45     120-80 -1.3269   200-120  -.2630   500-200  -.1562 225M
     CH  46-46     120-80 -1.3478   200-120  -.2655   500-200  -.1587 230M
     CH  47-47     120-80 -1.3653   200-120  -.2728   500-200  -.1598 235M
     CH  48-48     120-80 -1.3826   200-120  -.2773   500-200  -.1614 240M
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1973 STATIØN 77 FEB PA 10**4 AVE 5 DEPTH 114 M DEPTH 117 M SWEEP 170 M
     MEAN VALUE ØF PRØFILES ØVER 5M INTERVALS

     CH    1- 2      120-80  -.0287   200-120   .2137    500-200  -.4932    5M
     CH    3- 4      120-80   .6334   200-120  -.6268    500-200  -.4741   10M
     CH    5- 6      120-80  1.0943   200-120 -1.2711    500-200  -.4803   15M
     CH    7- 8      120-80  1.0966   200-120 -1.3357    500-200  -.4839   20M
     CH    9-10      120-80  1.1000   200-120 -1.3169    500-200  -.4970   25M
     CH   11-12      120-80  1.1023   200-120 -1.3169    500-200  -.4966   30M
     CH   13-14      120-80  1.0905   200-120 -1.3089    500-200  -.5061   35M
     CH   15-16      120-80  1.0861   200-120 -1.3028    500-200  -.5065   40M
     CH   17-18      120-80  1.0769   200-120 -1.2899    500-200  -.5137   45M
     CH   19-20      120-80  1.0697   200-120 -1.2836    500-200  -.5163   50M
     CH   21-22      120-80  1.0632   200-120 -1.2872    500-200  -.5239   55M
     CH   23-24      120-80  1.0527   200-120 -1.2903    500-200  -.5286   60M
     CH   25-26      120-80  1.0281   200-120 -1.2909    500-200  -.5324   65M
     CH   27-28      120-80  1.0206   200-120 -1.2876    500-200  -.5353   70M
     CH   29-30      120-80   .9865   200-120 -1.2902    500-200  -.5365   75M
     CH   31-32      120-80   .9662   200-120 -1.2996    500-200  -.5429   80M
     CH   33-34      120-80   .9511   200-120 -1.3022    500-200  -.5454   85M
     CH   35-36      120-80   .9404   200-120 -1.2993    500-200  -.5510   90M
     CH   37-38      120-80   .9351   200-120 -1.2996    500-200  -.5502   95M
     CH   39-40      120-80   .9121   200-120 -1.3050    500-200  -.5561  100M
     CH   41-42      120-80   .8915   200-120 -1.3050    500-200  -.5542  105M
     CH   43-44      120-80   .8678   200-120 -1.2983    500-200  -.5620  110M
     CH   45-46      120-80   .8633   200-120 -1.2988    500-200  -.5592  115M


1973 STATIØN 78 FEB PA 10**4 AVE 5 DEPTH 53 M DEPTH 60 M SWEEP 62 M
     MEAN VALUE OF PRØFILES OVER 5M INTERVALS

     CH    1- 8      120-80   .1114   200-120  -.6706    500-200   .3350    5M
     CH    9-16      120-80   .2226   200-120 -1.6379    500-200   .3489   10M
     CH   17-24      120-80  -.1835   200-120 -2.1752    500-200   .3570   15M
     CH   25-32      120-80  -.5899   200-120 -2.7118    500-200   .3656   20M
     CH   33-40      120-80 -1.3538   200-120 -2.8909    500-200   .3737   25M
     CH   41-48      120-80 -1.4856   200-120 -2.8857    500-200   .3846   30M
     CH   49-56      120-80 -2.1025   200-120 -2.8816    500-200   .3943   35M
     CH   57-64      120-80 -2.3286   200-120 -2.8796    500-200   .4031   40M
     CH   65-72      120-80 -2.3058   200-120 -2.8701    500-200   .4122   45M
     CH   73-80      120-80 -2.3735   200-120 -2.8576    500-200   .4191   50M
     CH   81-88      120-80 -2.3784   200-120 -2.8424    500-200   .4256   55M
     CH   89-96      120-80 -2.3732   200-120 -2.8323    500-200  -.2371   60M
1973
     FEB STA 79 PA 10**4 AVG 5 DEPTH 20 DEPTH 20 SCAN 25
     MEAN VALUE ØF PROFILES ØVER 5M INTERVALS

     CH    1-20      120-80   .4707   200-120 -1.1038    500-200   .0150    5M
     CH   21-40      120-80   .3578   200-120  -.5487    500-200   .0340   10M
     CH   41-60      120-80 -1.3082   200-120  -.0337    500-200   .0511   15M
     CH   61-80      120-80 -2.8882   200-120   .6505    500-200   .0710   20M
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1973 STATIØN 83 FEB PA 10** 4  AVE 5 DEPTH 99 M DEPTH 96 M SWEEP 130 M
     MEAN VALUE ØF PRØFILES ØVER 5M INTERVALS

     CH    1- 3     120-80   .7863   200-120   .3639   500-200  -.5240   5M
     CH    4- 6     120-80  1.1546   200-120   .2903   500-200  -.5934  10M
     CH    7- 9     120-80  1.3321   200-120   .1645   500-200  -.6616  15M
     CH   10-12     120-80  1.3190   200-120   .2255   500-200  -.7316  20M
     CH   13-15     120-80  1.3024   200-120   .2902   500-200  -.7971  25M
     CH   16-18     120-80  1.2793   200-120   .3573   500-200  -.8633  30M
     CH   19-21     120-80  1.2572   200-120   .4256   500-200  -.9269  35M
     CH   22-24     120-80  1.2397   200-120   .4897   500-200  -.9933  40M
     CH   25-27     120-80  1.2218   200-120   .5549   500-200 -1.0573  45M
     CH   28-30     120-80  1.1975   200-120   .6244   500-200 -1.1230  50M
     CH   31-33     120-80  1.1851   200-120   .6893   500-200 -1.1867  55M
     CH   34-36     120-80  1.1667   200-120   .7578   500-200 -1.2478  60M
     CH   37-39     120-80  1.1580   200-120   .8128   500-200 -1.3098  65M
     CH   40-42     120-80  1.1983   200-120   .8145   500-200 -1.3724  70M
     CH   43-45     120-80  1.1770   200-120   .8800   500-200 -1.4346  75M
     CH   46-48     120-80  1.1614   200-120   .9425   500-200 -1.4963  80M
     CH   49-51     120-80  1.1442   200-120  1.0062   500-200 -1.5577  85M
     CH   52-54     120-80  1.1230   200-120  1.0684   500-200 -1.6204  90M
     CH   55-57     120-80  1.1025   200-120  1.1301   500-200 -1.6834  95M
1973 STATIØN 85 FEB PA 10**4 AVE 5 DEPTH 188 M DEPTH 186 M SWEEP 225 M
     MEAN VALUE ØF PRØFILES ØVER 5M INTERVALS

     CH    1- 2     120-80  -.0046   200-120  -.0275   500-200  -.0033   5M
     CH    3- 4     120-80  -.0221   200-120  -.0455   500-200  -.0100  10M
     CH    5- 6     120-80  -.0379   200-120  -.0602   500-200  -.0167  15M
     CH    7- 8     120-80  -.0504   200-120  -.0752   500-200  -.0202  20M
     CH    9-10     120-80  -.0702   200-120  -.0870   500-200  -.0226  25M
     CH   11-12     120-80  -.0891   200-120  -.0998   500-200  -.0240  30M
     CH   13-14     120-80  -.1045   200-120  -.1191   500-200  -.0243  35M
     CH   15-16     120-80  -.1240   200-120  -.1356   500-200  -.0269  40M
     CH   17-18     120-80  -.1418   200-120  -.1537   500-200  -.0290  45M
     CH   19-20     120-80  -.1544   200-120  -.1735   500-200  -.0314  50M
     CH   21-22     120-80  -.1695   200-120  -.1937   500-200  -.0319  55M
     CH   23-24     120-80  -.1828   200-120  -.2087   500-200  -.0292  60M
     CH   25-26     120-80  -.1972   200-120  -.2299   500-200  -.0265  65M
     CH   27-28     120-80  -.2126   200-120  -.2487   500-200  -.0263  70M
     CH   29-30     120-80  -.2274   200-120  -.2672   500-200  -.0246  75M
     CH   31-32     120-80  -.2415   200-120  -.2858   500-200  -.0235  80M
     CH   33-34     120-80  -.2543   200-120  -.3053   500-200  -.0228  85M
     CH   35-36     120-80  -.2670   200-120  -.3283   500-200  -.0221  90M
     CH   37-38     120-80  -.2846   200-120  -.3483   500-200  -.0216  95M
     CH   39-40     120-80  -.3014   200-120  -.3670   500-200  -.0207 100M
     CH   41-42     120-80  -.3142   200-120  -.3698   500-200  -.0200 105M
     CH   43-44     120-80  -.3250   200-120  -.4179   500-200  -.0201 110M
     CH   45-46     120-80  -.3451   200-120  -.4385   500-200  -.0192 115M
     CH   47-48     120-80  -.3625   200-120  -.4576   500-200  -.0179 120M
     CH   49-50     120-80  -.3749   200-120  -.4787   500-200  -.0174 125M
     CH   51-52     120-80  -.3909   200-120  -.5009   500-200  -.0159 130M
     CH   53-54     120-80  -.4033   200-120  -.5207   500-200  -.0162 135M
     CH   55-56     120-80  -.4188   200-120  -.5409   500-200  -.0154 140M
     CH   57-58     120-80  -.4346   200-120  -.5615   500-200  -.0126 145M
     CH   59-60     120-80  -.4491   200-120  -.5811   500-200  -.0123 150M
     CH   61-62     120-80  -.4647   200-120  -.6014   500-200  -.0114 155M
     CH   63-64     120-80  -.4771   200-120  -.6242   500-200  -.0118 160M
     CH   65-66     120-80  -.4911   200-120  -.6485   500-200  -.0143 165M
     CH   67-68     120-80  -.5043   200-120  -.6697   500-200  -.0165 170M
     CH   69-70     120-80  -.5177   200-120  -.6874   500-200  -.0185 175M
     CH   71-72     120-80  -.5343   200-120  -.7087   500-200  -.0181 180M
     CH   73-74     120-80  -.5485   200-120  -.7280   500-200  -.0180 185M
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1973 FEB STA 89  PA 10**4 AVG 5 DEPTH  76 M  DEPTH77 M SCAN 80 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 6     120-80   .7308   200-120  -.8955   500-200  -.0806   5M
     CH   7-12     120-80  1.4288   200-120 -1.4917   500-200  -.0845  10M
     CH  13-18     120-80  1.5022   200-120 -1.4980   500-200  -.0881  15M
     CH  19-24     120-80  1.4920   200-120 -1.4435   500-200  -.0897  20M
     CH  25-30     120-80  1.4869   200-120 -1.4026   500-200  -.0884  25M
     CH  31-36     120-80  1.4941   200-120 -1.4088   500-200  -.0834  30M
     CH  37-42     120-80  1.5038   200-120 -1.4183   500-200  -.0767  35M
     CH  43-48     120-80  1.4808   200-120 -1.4012   500-200  -.0709  40M
     CH  49-54     120-80  1.4838   200-120 -1.4036   500-200  -.0659  45M
     CH  55-60     120-80  1.4932   200-120 -1.4117   500-200  -.0625  50M
     CH  61-66     120-80  1.4891   200-120 -1.4207   500-200  -.0616  55M
     CH  67-72     120-80  1.4408   200-120 -1.4317   500-200  -.0621  60M
     CH  73-78     120-80  1.4345   200-120 -1.4453   500-200  -.0597  65M
     CH  79-84     120-80  1.4277   200-120 -1.4556   500-200  -.0575  70M
     CH  85-90     120-80  1.4351   200-120 -1.4695   500-200  -.1928  75M


1973 FEB STA 90 PA 10**4 AVG 5 DEPTH L3 DEPTH (SOUNDER) 20 SCAN 25
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-20     120-80  -.6544   200-120  1.6677   500-200   .1194   5M
     CH  21-40     120-80 -1.4540   200-120  1.6052   500-200   .0292  10M
     CH  41-60     120-80 -1.6604   200-120  1.4637   500-200  -.0634  15M
     CH  61-80     120-80 -1.4496   200-120   .7840   500-200  -.1611  20M


1973 FEB STA 92 PRE AMP 10*4 AVG 5 DEPTH 67 MGDEPTH 86 M  SCAN 100 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 5     120-80  1.0658   200-120  1.5550   500-200  -.6730   5M
     CH   6-10     120-80  2.0924   200-120  1.0485   500-200  -.7816  10M
     CH  11-15     120-80  2.6162   200-120   .6488   500-200  -.8944  15M
     CH  16-20     120-80  4.4286   200-120 -1.0404   500-200 -1.0069  20M
     CH  21-25     120-80  5.4838   200-120 -1.9746   500-200 -1.1173  25M
     CH  26-30     120-80  5.7512   200-120 -2.1232   500-200 -1.2288  30M
     CH  31-35     120-80  5.8356   200-120 -2.0902   500-200 -1.3405  35M
     CH  36-40     120-80  5.9163   200-120 -2.0524   500-200 -1.4528  40M
     CH  41-45     120-80  5.9479   200-120 -1.9641   500-200 -1.5674  45M
     CH  46-50     120-80  5.9550   200-120 -1.8513   500-200 -1.6793  50M
     CH  51-55     120-80  5.9536   200-120 -1.7304   500-200 -1.7922  55M
     CH  56-60     120-80  5.9611   200-120 -1.6160   500-200 -1.9069  60M
     CH  61-65     120-80  5.9678   200-120 -1.5021   500-200 -2.0234  65M
     CH  66-70     120-80  5.9766   200-120 -1.3924   500-200 -2.1378  70M
     CH  71-75     120-80  5.9901   200-120 -1.2860   500-200 -2.2525  75M
     CH  76-80     120-80  5.9998   200-120 -1.1779   500-200 -2.3666  80M
     CH  81-85     120-80  6.0088   200-120 -1.0712   500-200 -2.4801  85M
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1973 FEB STA 95 PA 10**4 AVG 5 DEPTH 18 M DEPTH 25 M SCAN 30 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-16     120-80   .1014   200-120  -.7959    500-200  -.5320   5M
     CH  17-32     120-80   .2023   200-120 -1.4958    500-200  -.8000  10M
     CH  33-48     120-80   .3033   200-120 -1.4673    500-200  -.7688  15M
     CH  49-64     120-80   .4044   200-120  -.9192    500-200  -.7344  20M
     CH  65-80     120-80   .5053   200-120  -.3733    500-200  -.6988  25M


1973 FEB STA 105  PA 10**4 AVG 5 DEPTH26 J DEPTH 18 SWEEP 30
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-20     120-80  1.1257   200-120  -.7816    500-200  -.0717   5M
     CH  21-40     120-80   .9819   200-120 -1.6272    500-200  -.0661  10M
     CH  41-60     120-80   .8454   200-120 -2.1278    500-200  -.0630  15M
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73 JUN STATION 1 DEPTH 31 M SWEEP 36 M
   MEAN VALUE OF PROFILES OVER 5M INTERVALS

   CH   1-14     120-80   .0661   200-120  -.0614   500-200   .0000    5M
   CH  15-28     120-80   .2090   200-120  -.1548   500-200   .0000   10M
   CH  29-42     120-80   .2688   200-120  -.2269   500-200   .0000   15M
   CH  43-56     120-80   .2456   200-120  -.2657   500-200   .0000   20M
   CH  57-70     120-80   .1483   200-120  -.2867   500-200   .0000   25M
   CH  71-84     120-80   .1245   200-120  -.2703   500-200   .0000   30M
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1973 JUN STATION 2 DEPTH 20 M SWEEP 26 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-19     120-80   .0047   200-120 -1.0095   500-200   .0000    5M
     CH  20-38     120-80  -.5464   200-120 -1.9888   500-200   .0000   10M
     CH  39-57     120-80 -1.5684   200-120 -2.4983   500-200   .0000   15M
     CH  58-76     120-80 -2.8411   200-120 -2.7273   500-200   .0000   20M
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1973 JUN STATION 3 DEPTH 15 M SWEEP 25 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-20     120-80   .6524   200-120  -.9229   500-200   .0000    5M
     CH  21-40     120-80  1.5677   200-120 -2.2619   500-200   .0000   10M
     CH  41-60     120-80  2.5898   200-120 -3.7662   500-200   .0000   15M
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1973 JUN STATION 5 DEPTH 92 M SWEEP 80 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 6     120-80 -1.3735   200-120  -.0858   500-200   .0000    5M
     CH   7-12     120-80 -2.7440   200-120  -.0459   500-200   .0000   10M
     CH  13-18     120-80 -3.8318   200-120   .0092   500-200   .0000   15M
     CH  19-24     120-80 -4.5961   200-120   .0653   500-200   .0000   20M
     CH  25-30     120-80 -4.8751   200-120   .1233   500-200   .0000   25M
     CH  31-36     120-80 -4.8662   200-120   .1778   500-200   .0000   30M
     CH  37-42     120-80 -4.8622   200-120   .2365   500-200   .0000   35M
     CH  43-48     120-80 -4.8603   200-120   .2949   500-200   .0000   40M
     CH  49-54     120-80 -4.8591   200-120   .3539   500-200   .0000   45M
     CH  55-60     120-80 -4.8593   200-120   .4117   500-200   .0000   50M
     CH  61-66     120-80 -4.8590   200-120   .4701   500-200   .0000   55M
     CH  67-72     120-80 -4.8566   200-120   .5293   500-200   .0000   60M
     CH  73-78     120-80 -4.8553   200-120   .5883   500-200   .0000   65M
     CH  79-84     120-80 -4.8527   200-120   .6460   500-200   .0000   70M
     CH  85-90     120-80 -4.8525   200-120   .7063   500-200   .0000   75M
     CH  91-96     120-80 -4.8510   200-120   .7656   500-200   .0000   80M
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1973 JUN STATION 7 DEPTH 23 M SWEEP 45 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-12     120-80  -.0226   200-120  1.5001   500-200   .0000   5M
     CH   13-24     120-80  -.0167   200-120  2.9902   500-200   .0000  10M
     CH   25-36     120-80   .0061   200-120  4.4763   500-200   .0000  15M
     CH   37-48     120-80   .0902   200-120  5.9475   500-200   .0000  20M

1973
     JUN STATION 8 DEPTH 75 M SWEEP 77 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 6     120-80  1.4886   200-120 -1.8061   500-200   .1487   5M
     CH    7-12     120-80  2.2592   200-120 -2.5997   500-200   .3355  10M
     CH   13-18     120-80  3.0620   200-120 -3.2899   500-200   .5250  15M
     CH   19-24     120-80  3.8796   200-120 -3.9801   500-200   .7164  20M
     CH   25-30     120-80  4.7051   200-120 -4.6675   500-200   .9094  25M
     CH   31-36     120-80  5.5224   200-120 -5.3547   500-200  1.1024  30M
     CH   37-42     120-80  6.3356   200-120 -6.0414   500-200  1.2982  35M
     CH   43-48     120-80  7.1514   200-120 -6.7287   500-200  1.4950  40M
     CH   49-54     120-80  7.9677   200-120 -7.4185   500-200  1.6931  45M
     CH   55-60     120-80  8.7856   200-120 -8.1093   500-200  1.8922  50M
     CH   61-66     120-80  9.6028   200-120 -8.7996   500-200  2.0921  55M
     CH   67-72     120-80 10.4195   200-120 -9.4914   500-200  2.2925  60M
     CH   73-78     120-80 11.2377   200-120-10.1841   500-200  2.4942  65M
     CH   79-84     120-80 12.0472   200-120-10.8679   500-200  2.6962  70M
     CH   85-90     120-80 12.8663   200-120-11.5620   500-200  2.8989  75M

1973 JUN STATION 10 DEPTH 117 M SWEEP 200 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2     120-80   .0019   200-120   .1065   500-200   .1882   5M
     CH    3- 4     120-80   .0023   200-120   .2123   500-200   .3773  10M
     CH    5- 6     120-80  -.0009   200-120   .3207   500-200   .5701  15M
     CH    7- 8     120-80  -.0008   200-120   .4277   500-200   .7353  20M
     CH    9-10     120-80  -.0020   200-120   .5343   500-200   .9065  25M
     CH   11-12     120-80  -.0013   200-120   .6344   500-200  1.0983  30M
     CH   13-14     120-80  -.0024   200-120   .7643   500-200  1.2461  35M
     CH   15-16     120-80  -.0024   200-120   .8960   500-200  1.4510  40M
     CH   17-18     120-80   .0000   200-120  1.0164   500-200  1.6573  45M
     CH   19-20     120-80   .0023   200-120  1.1464   500-200  1.8635  50M
     CH   21-22     120-80   .0046   200-120  1.2509   500-200  2.0706  55M
     CH   23-24     120-80   .0092   200-120  1.3542   500-200  2.2783  60M
     CH   25-26     120-80   .0124   200-120  1.4576   500-200  2.4856  65M
     CH   27-28     120-80   .0164   200-120  1.6517   500-200  2.6943  70M
     CH   29-30     120-80   .0200   200-120  1.7417   500-200  2.9024  75M
     CH   31-32     120-80   .0248   200-120  1.8328   500-200  3.1119  80M
     CH   33-34     120-80   .0298   200-120  1.9220   500-200  3.3210  85M
     CH   35-36     120-80   .0350   200-120  2.0129   500-200  3.5975  90M
     CH   37-38     120-80   .0397   200-120  2.1041   500-200  3.8049  95M
     CH   39-40     120-80   .0449   200-120  2.1934   500-200  4.0119 100M
     CH   41-42     120-80   .0496   200-120  2.2812   500-200  4.2200 105M
     CH   43-44     120-80   .0536   200-120  2.3709   500-200  4.4282 110M
     CH   45-46     120-80   .0593   200-120  2.4604   500-200  4.6373 115M
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1973 JUN STATION 12 DEPTH 20 M SWEEP 35 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-14     120-80  1.0789   200-120  -.9582   500-200    .0000   5M
     CH  15-28     120-80  2.7429   200-120 -2.2200   500-200    .0000  10M
     CH  29-42     120-80  2.6272   200-120 -1.4739   500-200    .0000  15M
     CH  43-56     120-80  2.6024   200-120  -.7371   500-200    .0000  20M


1973 JUN STATION 14 DEPTH 10 M SWEEP 16 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-31     120-80  1.7635   200-120   .3129   500-200   -.1166   5M
     CH  32-62     120-80  1.8336   200-120   .5652   500-200    .0738  10M


1973 JUN STATION 19 DEPTH 24 M SWEEP 30 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-20     120-80  -.1868   200-120 -1.4627   500-200    .0000   5M
     CH  21-40     120-80  -.4055   200-120 -2.9283   500-200    .0000  10M
     CH  41-60     120-80  -.3634   200-120 -4.4732   500-200    .0000  15M
     CH  61-80     120-80  -.3863   200-120 -5.7904   500-200    .0000  20M

1973 JUN STATION 20 DEPTH 20 M SWEEP 35 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-14     120-80   .3982   200-120  -.4693   500-200    .2099   5M
     CH  15-28     120-80   .5869   200-120  -.7431   500-200    .4192  10M
     CH  29-42     120-80   .7083   200-120  -.9830   500-200    .6307  15M
     CH  43-56     120-80   .8313   200-120 -1.2037   500-200    .8432  20M

1973 JUN STATION 24 DEPTH 118 M SWEEP 80 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 6     120-80   .6946   200-120   .8519   500-200   -.6396   5M
     CH   7-12     120-80  1.0869   200-120  1.7899   500-200   -.4675  10M
     CH  13-18     120-80  1.5844   200-120  2.2507   500-200   -.2935  15M
     CH  19-24     120-80  2.0422   200-120  2.3849   500-200   -.1154  20M
     CH  25-30     120-80  2.5621   200-120  2.0919   500-200    .0689  25M
     CH  31-36     120-80  2.8827   200-120  1.8680   500-200    .2534  30M
     CH  37-42     120-80  3.1063   200-120  1.7185   500-200    .4377  35M
     CH  43-48     120-80  3.2490   200-120  1.6447   500-200    .6208  40M
     CH  49-54     120-80  3.4023   200-120  1.5558   500-200    .8015  45M
     CH  55-60     120-80  3.6563   200-120  1.3712   500-200    .9828  50M
     CH  61-66     120-80  3.7983   200-120  1.3005   500-200   1.1672  55M
     CH  67-72     120-80  3.8523   200-120  1.3154   500-200   1.3539  60M
     CH  73-78     120-80  3.9225   200-120  1.3181   500-200   1.5391  65M
     CH  79-84     120-80  3.9475   200-120  1.3627   500-200   1.7217  70M
     CH  85-90     120-80  3.9438   200-120  1.4357   500-200   1.9045  75M
     CH  91-96     120-80  3.9485   200-120  1.5015   500-200   2.0878  80M
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1973 JUN STATION 26 DEPTH 150 M SWEEP 80 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 6     120-80  -.1899    200-120  2.2907    500-200  -.5982    5M
     CH    7-12     120-80  1.3670    200-120  2.2182    500-200  -.6518   10M
     CH   13-18     120-80  2.4373    200-120  1.9633    500-200  -.7166   15M
     CH   19-24     120-80  3.4168    200-120  1.5367    500-200  -.7798   20M
     CH   25-30     120-80  4.1056    200-120  1.3485    500-200  -.8569   25M
     CH   31-36     120-80  4.6301    200-120  1.3248    500-200  -.9414   30M
     CH   37-42     120-80  4.7887    200-120  1.6649    500-200 -1.0178   35M
     CH   43-48     120-80  4.7360    200-120  2.2156    500-200 -1.1004   40M
     CH   49-54     120-80  4.6541    200-120  2.7989    500-200 -1.1824   45M
     CH   55-60     120-80  4.5655    200-120  3.3873    500-200 -1.2662   50M
     CH   61-66     120-80  4.4800    200-120  3.9672    500-200 -1.3477   55M
     CH   67-72     120-80  4.3947    200-120  4.5465    500-200 -1.4304   60M
     CH   73-78     120-80  4.3109    200-120  5.1252    500-200 -1.5181   65M
     CH   79-84     120-80  4.2256    200-120  5.7049    500-200 -1.6072   70M
     CH   85-90     120-80  4.1430    200-120  6.2826    500-200 -1.6957   75M
     CH   91-96     120-80  4.0599    200-120  6.8589    500-200 -1.7845   80M


1973 JUN STATION 30 DEPTH 28 MSWEEP 34 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-16     120-80  1.5484    200-120 -1.5676    500-200   .1422    5M
     CH   17-32     120-80  1.7214    200-120 -3.1265    500-200   .3206   10M
     CH   33-48     120-80   .3102    200-120 -2.8317    500-200   .5026   15M
     CH   49-64     120-80   .9679    200-120 -4.3425    500-200   .6876   20M
     CH   65-80     120-80  1.7152    200-120 -5.7465    500-200   .8759   25M


1973 JUN STATION 31 DEPTH 36 M SWEEP 44 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-11     120-80 -1.3670    200-120   .9092    500-200  -.1578    5M
     CH   12-22     120-80 -2.6180    200-120  1.8419    500-200   .0157   10M
     CH   23-33     120-80 -3.4127    200-120  2.5003    500-200   .1876   15M
     CH   34-44     120-80 -3.7807    200-120  2.9365    500-200   .3609   20M
     CH   45-55     120-80 -2.1054    200-120  1.3575    500-200   .5351   25M
     CH   56-66     120-80  -.6794    200-120   .0030    500-200   .7097   30M
     CH   67-77     120-80   .3050    200-120  -.9270    500-200   .8843   35M
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1973 JUN STATION 32 DEPTH 166 M SWEEP 210 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 2      120-80    .3403    200-120  -.0829    500-200    .0922    5M
     CH    3- 4      120-80    .3895    200-120  -.0716    500-200    .2785   10M
     CH    5- 6      120-80    .3968    200-120  -.0135    500-200    .4655   15M
     CH    7- 8      120-80    .4021    200-120   .0445    500-200    .6539   20M
     CH    9-10      120-80    .4068    200-120   .1036    500-200    .8425   25M
     CH   11-12      120-80    .4136    200-120   .1613    500-200   1.0316   30M
     CH   13-14      120-80    .4228    200-120   .2172    500-200   1.2215   35M
     CH   15-16      120-80    .4273    200-120   .2742    500-200   1.4104   40M
     CH   17-18      120-80    .4353    200-120   .3304    500-200   1.5999   45M
     CH   19-20      120-80    .4424    200-120   .3866    500-200   1.7894   50M
     CH   21-22      120-80    .4483    200-120   .4439    500-200   1.9795   55M
     CH   23-24      120-80    .4514    200-120   .5017    500-200   2.1695   60M
     CH   25-26      120-80    .4574    200-120   .5577    500-200   2.3586   65M
     CH   27-28      120-80    .4613    200-120   .6143    500-200   2.5489   70M
     CH   29-30      120-80    .4704    200-120   .6675    500-200   2.7392   75M
     CH   31-32      120-80    .4857    200-120   .7150    500-200   2.9293   80M
     CH   33-34      120-80    .5150    200-120   .7478    500-200   3.1210   85M
     CH   35-36      120-80    .5337    200-120   .7910    500-200   3.3124   90M
     CH   37-38      120-80    .5445    200-120   .8425    500-200   3.5033   95M
     CH   39-40      120-80    .5521    200-120   .8958    500-200   3.6937  100M
     CH   41-42      120-80    .5664    200-120   .9430    500-200   3.8839  105M
     CH   43-44      120-80    .5738    200-120   .9977    500-200   4.0744  110M
     CH   45-46      120-80    .5803    200-120  1.0520    500-200   4.2648  115M
     CH   47-48      120-80    .5826    200-120  1.1115    500-200   4.4550  120M
     CH   49-50      120-80    .5845    200-120  1.1702    500-200   4.6456  125M
     CH   51-52      120-80    .5848    200-120  1.2305    500-200   4.8353  130M
     CH   53-54      120-80    .5901    200-120  1.2862    500-200   5.0262  135M
     CH   55-56      120-80    .5964    200-120  1.3417    500-200   5.2164  140M
     CH   57-58      120-80    .6025    200-120  1.3980    500-200   5.4063  145M
     CH   59-60      120-80    .6078    200-120  1.4539    500-200   5.5973  150M
     CH   61-62      120-80    .6110    200-120  1.5118    500-200   5.7882  155M
     CH   63-64      120-80    .6173    200-120  1.5680    500-200   5.9785  160M
     CH   65-66      120-80    .6213    200-120  1.6231    500-200   6.1686  165M

1973 JUN STATION 35 DEPTH 17 M SWEEP 23 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-24      120-80  -.7731    200-120  -.2594    500-200    .2465    5M
     CH   25-48      120-80 -1.9866    200-120  -.5706    500-200    .4588   10M
     CH   49-72      120-80 -3.2522    200-120  -.8169    500-200    .6831   15M

1973 JUN STATION 36 DEPTH 23 M SWEEP 30 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-19      120-80    .2627    200-120   .2553    500-200  -.3951    5M
     CH   20-38      120-80    .8282    200-120   .1325    500-200  -.1846   10M
     CH   39-57      120-80  -.3681    200-120  1.6889    500-200    .0313   15M
     CH   58-76      120-80    .5869    200-120  1.0506    500-200  -.0130   20M
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1973 JUN STATION 41 DEPTH 24 M SWEEP 30 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-20      120-80  -.8813   200-120  -.0138   500-200   .0000    5M
     CH   21-40      120-80 -1.5833   200-120  -.1566   500-200   .0000   10M
     CH   41-60      120-80 -2.4400   200-120  -.3096   500-200   .0000   15M
     CH   61-80      120-80 -3.0622   200-120  -.4188   500-200   .0000   20M

1973 JUN STATION 42 DEPTH 24 M SWEEP 40 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-15      120-80   .0161   200-120  2.6406   500-200   .0000    5M
     CH   16-30      120-80   .3133   200-120  5.0390   500-200   .0000   10M
     CH   31-45      120-80  -.9740   200-120  7.4506   500-200   .0000   15M
     CH   46-60      120-80 -2.1247   200-120  9.6900   500-200   .0000   20M

1973 JUN STATION 46 DEPTH 128 M SWEEP 80 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 6      120-80  -.6775   200-120   .0238   500-200   .0000    5M
     CH    7-12      120-80 -1.1781   200-120   .0868   500-200   .0000   10M
     CH   13-18      120-80 -1.1340   200-120   .1574   500-200   .0000   15M
     CH   19-24      120-80 -2.0774   200-120   .2207   500-200   .0000   20M
     CH   25-30      120-80 -2.5017   200-120   .2829   500-200   .0000   25M
     CH   31-36      120-80 -2.6689   200-120   .3504   500-200   .0000   30M
     CH   37-42      120-80 -2.6752   200-120   .4215   500-200   .0000   35M
     CH   43-48      120-80 -2.6654   200-120   .4901   500-200   .0000   40M
     CH   49-54      120-80 -2.6583   200-120   .5603   500-200   .0000   45M
     CH   55-60      120-80 -2.6542   200-120   .6270   500-200   .0000   50M
     CH   61-66      120-80 -2.6454   200-120   .6911   500-200   .0000   55M
     CH   67-72      120-80 -2.6390   200-120   .7573   500-200   .0000   60M
     CH   73-78      120-80 -2.6253   200-120   .8222   500-200   .0000   65M
     CH   79-84      120-80 -2.6153   200-120   .8911   500-200   .0000   70M
     CH   85-90      120-80 -2.6067   200-120   .9601   500-200   .0000   75M
     CH   91-96      120-80 -2.5985   200-120  1.0305   500-200   .0000   80M

1973 JUN STATION 48 DEPTH 33 M SWEEP 40 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-13      120-80   .8276   200-120  -.7323   500-200   .1921    5M
     CH   14-26      120-80   .3252   200-120 -1.5277   500-200   .3992   10M
     CH   27-39      120-80  -.0821   200-120 -2.0739   500-200   .6053   15M
     CH   40-52      120-80  -.7952   200-120 -2.3069   500-200   .8119   20M
     CH   53-65      120-80 -1.6802   200-120 -2.3536   500-200  1.0188   25M
     CH   66-78      120-80 -2.4513   200-120 -2.3489   500-200  1.2257   30M
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1973 JUN STATION 56 DEPTH 129 M SWEEP 160 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 3    120-80  -.0852   200-120    .0266   500-200   .2683   5M
     CH   4- 6    120-80  -.0844   200-120    .0787   500-200   .5741  10M
     CH   7- 9    120-80  -.0853   200-120    .1296   500-200   .9414  15M
     CH  10-12    120-80  -.0874   200-120    .1834   500-200  1.3118  20M
     CH  13-15    120-80  -.0898   200-120    .2382   500-200  1.6877  25M
     CH  16-18    120-80  -.0913   200-120    .2925   500-200  2.0413  30M
     CH  19-21    120-80  -.0925   200-120    .3471   500-200  2.3957  35M
     CH  22-24    120-80  -.0910   200-120    .4012   500-200  2.7860  40M
     CH  25-27    120-80  -.0928   200-120    .4536   500-200  3.1943  45M
     CH  28-30    120-80  -.0933   200-120    .5060   500-200  3.6144  50M
     CH  31-33    120-80  -.0940   200-120    .5567   500-200  4.0321  55M
     CH  34-36    120-80  -.0964   200-120    .6078   500-200  4.4797  60M
     CH  37-39    120-80  -.1006   200-120    .6602   500-200  4.9467  65M
     CH  40-42    120-80  -.1030   200-120    .7124   500-200  5.4239  70M
     CH  43-45    120-80  -.1027   200-120    .7602   500-200  5.9134  75M
     CH  46-48    120-80  -.1027   200-120    .8087   500-200  6.3698  80M
     CH  49-51    120-80  -.1045   200-120    .8594   500-200  6.8208  85M
     CH  52-54    120-80  -.1067   200-120    .9110   500-200  7.2695  90M
     CH  55-57    120-80  -.1069   200-120    .9593   500-200  7.7464  95M
     CH  58-60    120-80  -.1060   200-120   1.0082   500-200  8.2712 100M
     CH  61-63    120-80  -.1090   200-120   1.0612   500-200  8.8151 105M
     CH  64-66    120-80  -.1090   200-120   1.1121   500-200  9.3450 110M
     CH  67-69    120-80  -.1107   200-120   1.1641   500-200  9.8784 115M
     CH  70-72    120-80  -.1157   200-120   1.2193   500-200 10.3782 120M
     CH  73-75    120-80  -.1159   200-120   1.2715   500-200 10.9133 125M


1973 JUN STATION 59 DEPTH 16 M SWEEP 25 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-21    120-80   .1392   200-120  -.1365   500-200  -.5320   5M
     CH  22-42    120-80   .4157   200-120  -.0527   500-200  -.3452  10M
     CH  43-63    120-80   .7346   200-120  -.0909   500-200  -.1578  15M


1973 JUN STATION 60 DEPTH 16 M SWEEP 25 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-21    120-80  -.9337   200-120   .0874   500-200   .0000   5M
     CH  22-42    120-80 -2.0217   200-120   .1784   500-200   .0000  10M
     CH  43-63    120-80 -3.1040   200-120   .2210   500-200   .0000  15M
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1973 JUN STATION 62 DEPTH 170 M SWEEP 80 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 6    120-80  -.9102   200-120   .1181   500-200   .0000   5M
     CH   7-12    120-80 -1.2875   200-120   .1882   500-200   .0000  10M
     CH  13-18    120-80 -1.3485   200-120   .3025   500-200   .0000  15M
     CH  19-24    120-80 -1.3381   200-120   .4177   500-200   .0000  20M
     CH  25-30    120-80 -1.3330   200-120   .4743   500-200   .0000  25M
     CH  31-36    120-80 -1.3195   200-120   .5306   500-200   .0000  30M
     CH  37-42    120-80 -1.3115   200-120   .5910   500-200   .0000  35M
     CH  43-48    120-80 -1.3010   200-120   .6604   500-200   .0000  40M
     CH  49-54    120-80 -1.2879   200-120   .7231   500-200   .0000  45M
     CH  55-60    120-80 -1.2805   200-120   .7844   500-200   .0000  50M
     CH  61-66    120-80 -1.2728   200-120   .8451   500-200   .0000  55M
     CH  67-72    120-80 -1.2664   200-120   .9077   500-200   .0000  60M
     CH  73-78    120-80 -1.2580   200-120   .9709   500-200   .0000  65M
     CH  79-84    120-80 -1.2513   200-120  1.0322   500-200   .0000  70M
     CH  85-90    120-80 -1.2422   200-120  1.0936   500-200   .0000  75M
     CH  91-96    120-80 -1.2359   200-120  1.1548   500-200   .0000  80M

1973 JUN STATION 64 DEPTH 84 M SWEEP 80 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 5    120-80   .0304   200-120  -.7305   500-200   .0000   5M
     CH   6-10    120-80   .1315   200-120 -1.4903   500-200   .0000  10M
     CH  11-15    120-80   .2685   200-120 -1.8483   500-200   .0000  15M
     CH  16-20    120-80   .4162   200-120 -2.0222   500-200   .0000  20M
     CH  21-25    120-80   .5611   200-120 -2.1323   500-200   .0000  25M
     CH  26-30    120-80   .6525   200-120 -2.1727   500-200   .0000  30M
     CH  31-35    120-80   .6938   200-120 -2.1509   500-200   .0000  35M
     CH  36-40    120-80   .7128   200-120 -2.0970   500-200   .0000  40M
     CH  41-45    120-80   .7277   200-120 -2.0332   500-200   .0000  45M
     CH  46-50    120-80   .7447   200-120 -1.9815   500-200   .0000  50M
     CH  51-55    120-80   .7809   200-120 -1.9420   500-200   .0000  55M
     CH  56-60    120-80   .8036   200-120 -1.8952   500-200   .0000  60M
     CH  61-65    120-80   .8051   200-120 -1.8410   500-200   .0000  65M
     CH  66-70    120-80   .8279   200-120 -1.7928   500-200   .0000  70M
     CH  71-75    120-80   .8342   200-120 -1.7292   500-200   .0000  75M
     CH  76-80    120-80   .8424   200-120 -1.6670   500-200   .0000  80M

1973 JUN STATION 66 DEPTH 24 M SWEEP 35 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-17    120-80  1.0051   200-120  -.1764   500-200   .0000   5M
     CH  18-34    120-80  2.3576   200-120  -.6524   500-200   .0000  10M
     CH  35-51    120-80  1.9263   200-120 -1.2624   500-200   .0000  15M
     CH  52-68    120-80  1.4810   200-120 -1.8572   500-200   .0000  20M

1973
     JUN STATION 67 DEPTH 23 M SWEEP 25 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-23    120-80  -.0013   200-120  -.2649   500-200   .0000   5M
     CH  24-46    120-80   .1191   200-120  -.8394   500-200   .0000  10M
     CH  47-69    120-80   .5065   200-120 -1.7142   500-200   .0000  15M
     CH  70-92    120-80  1.2782   200-120 -2.9300   500-200   .0000  20M
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1973 JUN STATION 77 DEPTH 121 M SWEEP 80 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 6     120-80  -.6439   200-120    .0010   500-200   .0000   5M
     CH   7-12     120-80  -.9571   200-120    .0701   500-200   .0000  10M
     CH  13-18     120-80 -1.0026   200-120    .1374   500-200   .0000  15M
     CH  19-24     120-80 -1.0083   200-120    .2051   500-200   .0000  20M
     CH  25-30     120-80 -1.0053   200-120    .2705   500-200   .0000  25M
     CH  31-36     120-80 -1.0034   200-120    .3340   500-200   .0000  30M
     CH  37-42     120-80 -1.0054   200-120    .4007   500-200   .0000  35M
     CH  43-48     120-80 -1.0082   200-120    .4655   500-200   .0000  40M
     CH  49-54     120-80 -1.0095   200-120    .5296   500-200   .0000  45M
     CH  55-60     120-80 -1.0114   200-120    .5927   500-200   .0000  50M
     CH  61-66     120-80 -1.0108   200-120    .6562   500-200   .0000  55M
     CH  67-72     120-80 -1.0112   200-120    .7219   500-200   .0000  60M
     CH  73-78     120-80 -1.0106   200-120    .7861   500-200   .0000  65M
     CH  79-84     120-80 -1.0127   200-120    .8495   500-200   .0000  70M
     CH  85-90     120-80 -1.0131   200-120    .9141   500-200   .0000  75M
     CH  91-96     120-80 -1.0139   200-120    .9791   500-200   .0000  80M

1973 JUN STATION 78 DEPTH 56 M SWEEP 65 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 7     120-80  -.6326   200-120   -.2973   500-200   .0000   5M
     CH   8-14     120-80  -.9786   200-120   -.2996   500-200   .0000  10M
     CH  15-21     120-80 -1.1685   200-120   -.2393   500-200   .0000  15M
     CH  22-28     120-80 -1.1920   200-120   -.1626   500-200   .0000  20M
     CH  29-35     120-80 -1.1907   200-120   -.0888   500-200   .0000  25M
     CH  36-42     120-80 -1.1882   200-120   -.0153   500-200   .0000  30M
     CH  43-49     120-80 -1.1737   200-120    .0493   500-200   .0000  35M
     CH  50-56     120-80 -1.1643   200-120    .1173   500-200   .0000  40M
     CH  57-63     120-80 -1.1654   200-120    .1978   500-200   .0000  45M
     CH  64-70     120-80 -1.1737   200-120    .2815   500-200   .0000  50M
     CH  71-77     120-80 -1.1743   200-120    .3599   500-200   .0000  55M

1973 JUN STATION 79 DEPTH 21 M SWEEP 25 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-21     120-80  -.9098   200-120   -.2965   500-200   .1380   5M
     CH  22-42     120-80 -2.0332   200-120   -.7768   500-200   .2917  10M
     CH  43-63     120-80 -3.1336   200-120  -1.2460   500-200   .4471  15M
     CH  64-84     120-80 -4.1114   200-120  -1.8193   500-200   .6042  20M
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1973 JUN STATION 72 DEPTH 19 M SWEEP 25 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-25    120-80  -.3708   200-120  -.8728   500-200   .0000   5M
     CH  26-50    120-80  -.9020   200-120 -1.4381   500-200   .0000  10M
     CH  51-75    120-80 -1.3041   200-120 -2.0534   500-200   .0000  15M
1973 JUN STATION 73 DEPTH 16 M SWEEP 25 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-21    120-80  -.6939   200-120  -.2668   500-200   .0000   5M
     CH  22-42    120-80 -1.8630   200-120  -.4519   500-200   .0000  10M
     CH  43-63    120-80 -3.1527   200-120  -.5469   500-200   .0000  15M
1973 JUN STATION 75 DEPTH 225 M SWEEP 250 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1- 2    120-80   .3001   200-120  -.7141   500-200   .0000   5M
     CH   3- 4    120-80   .7334   200-120 -1.5796   500-200   .0000  10M
     CH   5- 6    120-80  1.1243   200-120 -2.4481   500-200   .0000  15M
     CH   7- 8    120-80  1.3270   200-120 -3.1870   500-200   .0000  20M
     CH   9-10    120-80  1.4641   200-120 -3.8199   500-200   .0000  25M
     CH  11-12    120-80  1.5024   200-120 -4.2906   500-200   .0000  30M
     CH  13-14    120-80  1.5427   200-120 -4.6332   500-200   .0000  35M
     CH  15-16    120-80  1.5437   200-120 -4.8557   500-200   .0000  40M
     CH  17-18    120-80  1.5375   200-120 -4.9778   500-200   .0000  45M
     CH  19-20    120-80  1.4947   200-120 -4.9985   500-200   .0000  50M
     CH  21-22    120-80  1.4473   200-120 -4.9746   500-200   .0000  55M
     CH  23-24    120-80  1.4195   200-120 -4.9548   500-200   .0000  60M
     CH  25-26    120-80  1.3940   200-120 -4.9206   500-200   .0000  65M
     CH  27-28    120-80  1.3728   200-120 -4.8862   500-200   .0000  70M
     CH  29-30    120-80  1.3549   200-120 -4.8464   500-200   .0000  75M
     CH  31-32    120-80  1.3356   200-120 -4.7958   500-200   .0000  80M
     CH  33-34    120-80  1.3276   200-120 -4.7540   500-200   .0000  85M
     CH  35-36    120-80  1.3201   200-120 -4.7095   500-200   .0000  90M
     CH  37-38    120-80  1.3183   200-120 -4.6634   500-200   .0000  95M
     CH  39-40    120-80  1.3228   200-120 -4.6217   500-200   .0000 100M
     CH  41-42    120-80  1.3336   200-120 -4.5813   500-200   .0000 105M
     CH  43-44    120-80  1.3387   200-120 -4.5380   500-200   .0000 110M
     CH  45-46    120-80  1.3429   200-120 -4.4974   500-200   .0000 115M
     CH  47-48    120-80  1.3456   200-120 -4.4566   500-200   .0000 120M
     CH  49-50    120-80  1.3468   200-120 -4.4160   500-200   .0000 125M
     CH  51-52    120-80  1.3504   200-120 -4.3747   500-200   .0000 130M
     CH  53-54    120-80  1.3548   200-120 -4.3342   500-200   .0000 135M
     CH  55-56    120-80  1.3570   200-120 -4.2936   500-200   .0000 140M
     CH  57-58    120-80  1.3584   200-120 -4.2574   500-200   .0000 145M
     CH  59-60    120-80  1.3619   200-120 -4.2180   500-200   .0000 150M
     CH  61-62    120-80  1.3675   200-120 -4.1791   500-200   .0000 155M
     CH  63-64    120-80  1.3706   200-120 -4.1410   500-200   .0000 160M
     CH  65-66    120-80  1.3741   200-120 -4.0994   500-200   .0000 165M
     CH  67-68    120-80  1.3786   200-120 -4.0600   500-200   .0000 170M
     CH  69-70    120-80  1.3834   200-120 -4.0217   500-200   .0000 175M
     CH  71-72    120-80  1.3870   200-120 -3.9789   500-200   .0000 180M
     CH  73-74    120-80  1.3886   200-120 -3.9380   500-200   .0000 185M
     CH  75-76    120-80  1.3916   200-120 -3.8997   500-200   .0000 190M
     CH  77-78    120-80  1.3948   200-120 -3.8577   500-200   .0000 195M
     CH  79-80    120-80  1.3959   200-120 -3.8165   500-200   .0000 200M
     CH  81-82    120-80  1.3983   200-120 -3.7780   500-200   .0000 205M
     CH  83-84    120-80  1.3994   200-120 -3.7363   500-200   .0000 210M
     CH  85-86    120-80  1.4027   200-120 -3.6953   500-200   .0000 215M
     CH  87-88    120-80  1.4044   200-120 -3.6545   500-200   .0000 220M
     CH  89-90    120-80  1.4075   200-120 -3.6124   500-200   .0000 225M
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1973 JUN STATION 89 DEPTH 72 M SWEEP 80 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS.

     CH    1- 6      120-80  -.0724   200-120   .1673    500-200    .0000   5M
     CH    7-12      120-80  1.1972   200-120 -1.0258    500-200    .0000  10M
     CH   13-18      120-80  1.8808   200-120 -1.6540    500-200    .0000  15M
     CH   19-24      120-80  2.1632   200-120 -1.8865    500-200    .0000  20M
     CH   25-30      120-80  2.2313   200-120 -1.8888    500-200    .0000  25M
     CH   31-36      120-80  2.2476   200-120 -1.8378    500-200    .0000  30M
     CH   37-42      120-80  2.2577   200-120 -1.7774    500-200    .0000  35M
     CH   43-48      120-80  2.2718   200-120 -1.7228    500-200    .0000  40M
     CH   49-54      120-80  2.2849   200-120 -1.6646    500-200    .0000  45M
     CH   55-60      120-80  2.2984   200-120 -1.6084    500-200    .0000  50M
     CH   61-66      120-80  2.3108   200-120 -1.5488    500-200    .0000  55M
     CH   67-72      120-80  2.3220   200-120 -1.4833    500-200    .0000  60M
     CH   73-78      120-80  2.3358   200-120 -1.4191    500-200    .0000  65M
     CH   79-84      120-80  2.3474   200-120 -1.3588    500-200    .0000  70M
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1973 JUN STATION 90 DEPTH 16 M SWEEP 25 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1-21      120-80  -.4795   200-120   .0017    500-200    .0000   5M
     CH   22-42      120-80  -.7790   200-120  -.1091    500-200    .0000  10M
     CH   43-63      120-80 -1.0059   200-120  -.2032    500-200    .0000  15M
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1973 JUN STATION 92 DEPTH 85 M SWEEP 110 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH    1- 4      120-80   .7034   200-120  1.0918    500-200  -.3655   5M
     CH    5- 8      120-80   .9638   200-120  1.3326    500-200  -.1512  10M
     CH    9-12      120-80  1.0260   200-120  1.4306    500-200   .0625  15M
     CH   13-16      120-80  1.0235   200-120  1.4902    500-200   .2781  20M
     CH   17-20      120-80  1.0227   200-120  1.5461    500-200   .4038  25M
     CH   21-24      120-80  1.0241   200-120  1.6044    500-200   .7123  30M
     CH   25-28      120-80  1.0266   200-120  1.6566    500-200   .9622  35M
     CH   29-32      120-80  1.0299   200-120  1.7094    500-200  1.2201  40M
     CH   33-36      120-80  1.0353   200-120  1.7614    500-200  1.4778  45M
     CH   37-40      120-80  1.0383   200-120  1.8136    500-200  1.7377  50M
     CH   41-44      120-80  1.0398   200-120  1.8697    500-200  1.9984  55M
     CH   45-48      120-80  1.0420   200-120  1.9215    500-200  2.2598  60M
     CH   49-52      120-80  1.0462   200-120  1.9721    500-200  2.5222  65M
     CH   53-56      120-80  1.0501   200-120  2.0212    500-200  2.7853  70M
     CH   57-60      120-80  1.0523   200-120  2.0711    500-200  3.0487  75M
     CH   61-64      120-80  1.0567   200-120  2.1202    500-200  3.3124  80M
     CH   65-68      120-80  1.0591   200-120  2.1705    500-200  3.5740  85M
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1973 JUN STATION 94 DEPTH 39 M SWEEP 43M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-12     120-80  -.3647   200-120   .9939   500-200   .0276   5M
     CH  13-24     120-80  -.4811   200-120  1.6060   500-200   .2414  10M
     CH  25-36     120-80  -.7694   200-120  2.0218   500-200   .4598  15M
     CH  37-48     120-80   .6710   200-120   .6465   500-200   .6872  20M
     CH  49-60     120-80  -.3225   200-120   .0523   500-200   .9295  25M
     CH  61-72     120-80 -1.2742   200-120  -.2305   500-200  1.1717  30M
     CH  73-84     120-80 -1.9256   200-120  -.4318   500-200  1.4150  35M
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1973 JUN STATION 95 DEPTH 29 M SWEEP 36 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-16     120-80   .7342   200-120   .7404   500-200  -.4187   5M
     CH  17-32     120-80  1.6290   200-120  1.5052   500-200  -.2376  10M
     CH  33-48     120-80  2.5813   200-120  2.0692   500-200  -.0564  15M
     CH  49-64     120-80  2.1100   200-120  2.3300   500-200   .1246  20M
     CH  65-80     120-80  1.9330   200-120  2.7151   500-200   .3057  25M
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1973 JUN STATION 96 DEPTH 37 M SWEEP 42 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-12     120-80  1.5756   200-120  -.9032   500-200   .0820   5M
     CH  13-24     120-80  1.5822   200-120 -2.0692   500-200   .2767  10M
     CH  25-36     120-80  1.7257   200-120 -3.3155   500-200   .4731  15M
     CH  37-48     120-80  1.7588   200-120 -4.3875   500-200   .6681  20M
     CH  49-60     120-80  1.7285   200-120 -5.1666   500-200   .8637  25M
     CH  61-72     120-80  1.7813   200-120 -5.6759   500-200  1.0596  30M
     CH  73-84     120-80  1.7997   200-120 -5.9004   500-200  1.2594  35M
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1973 JUN STATION 97 DEPTH 31 M SWEEP 35 M
     MEAN VALUE OF PROFILES OVER 5M INTERVALS

     CH   1-14     120-80  1.3671   200-120   .5094   500-200  -.3356   5M
     CH  15-28     120-80  2.9357   200-120   .4200   500-200  -.1604  10M
     CH  29-42     120-80  4.4587   200-120   .3413   500-200   .0170  15M
     CH  43-56     120-80  5.5974   200-120   .1452   500-200   .1954  20M
     CH  57-70     120-80  6.3758   200-120   .2209   500-200   .3735  25M
     CH  71-84     120-80  6.8454   200-120   .0839   500-200   .5374  30M
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